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AVIATION ENGINEERING

anuary 1935

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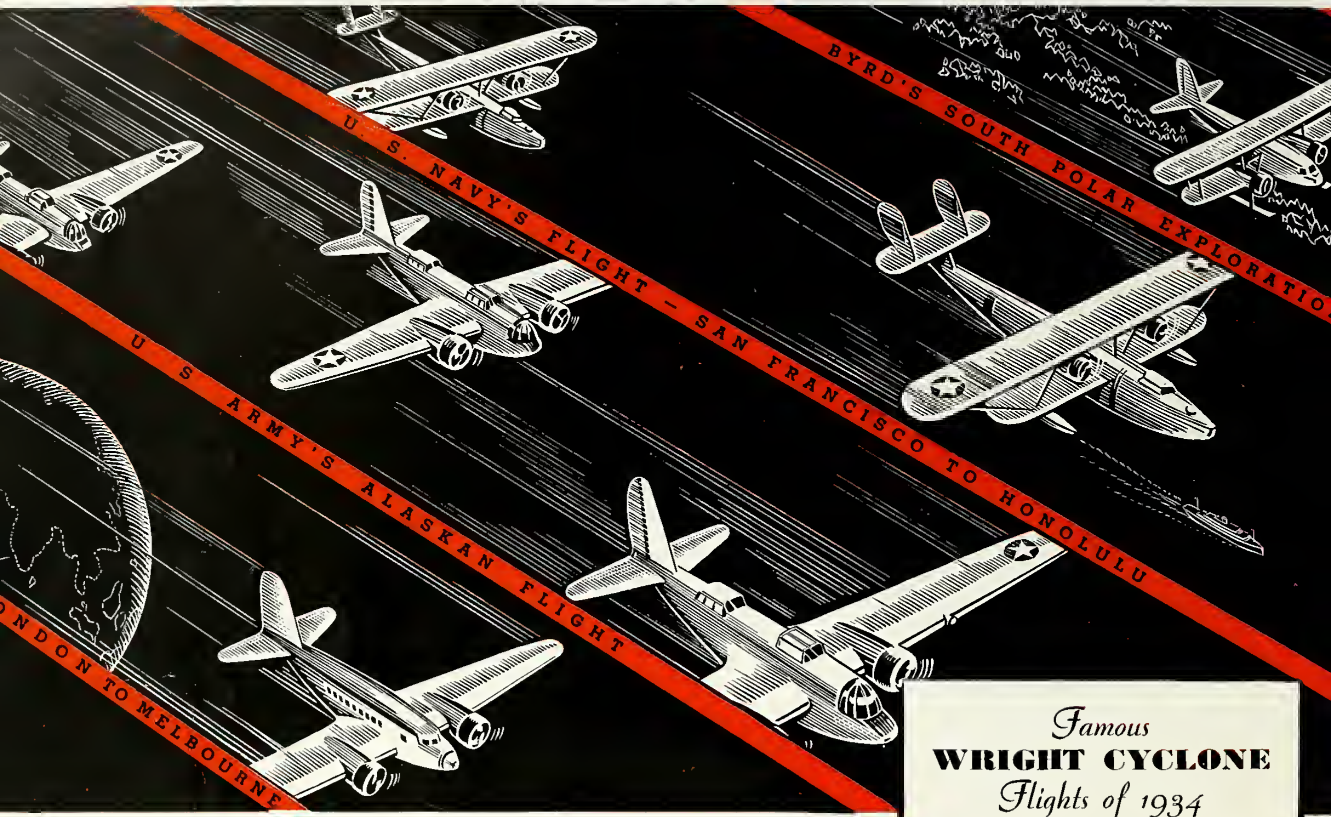
A Record-Breaking Year for WRIGHT CYCLONES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U S ARMY'S ALASKAN FLIGHT
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(11 Martin B-10 Bombers, each powered by 2 Wright Cyclones)

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(Vultee V1-A Transport, powered by a Wright Cyclone)

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(Douglas 14-passenger Airliner, powered by 2 Wright Cyclones)

TWA Air Mail flight of 2675 miles from Los Angeles to New York in 11 hours and 31 minutes.
(Northrop Gamma powered by a Wright Cyclone)

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(Douglas Airliner powered by 2 Wright Cyclones)

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(Curtiss-Wright Condor powered by 2 Wright Cyclones)

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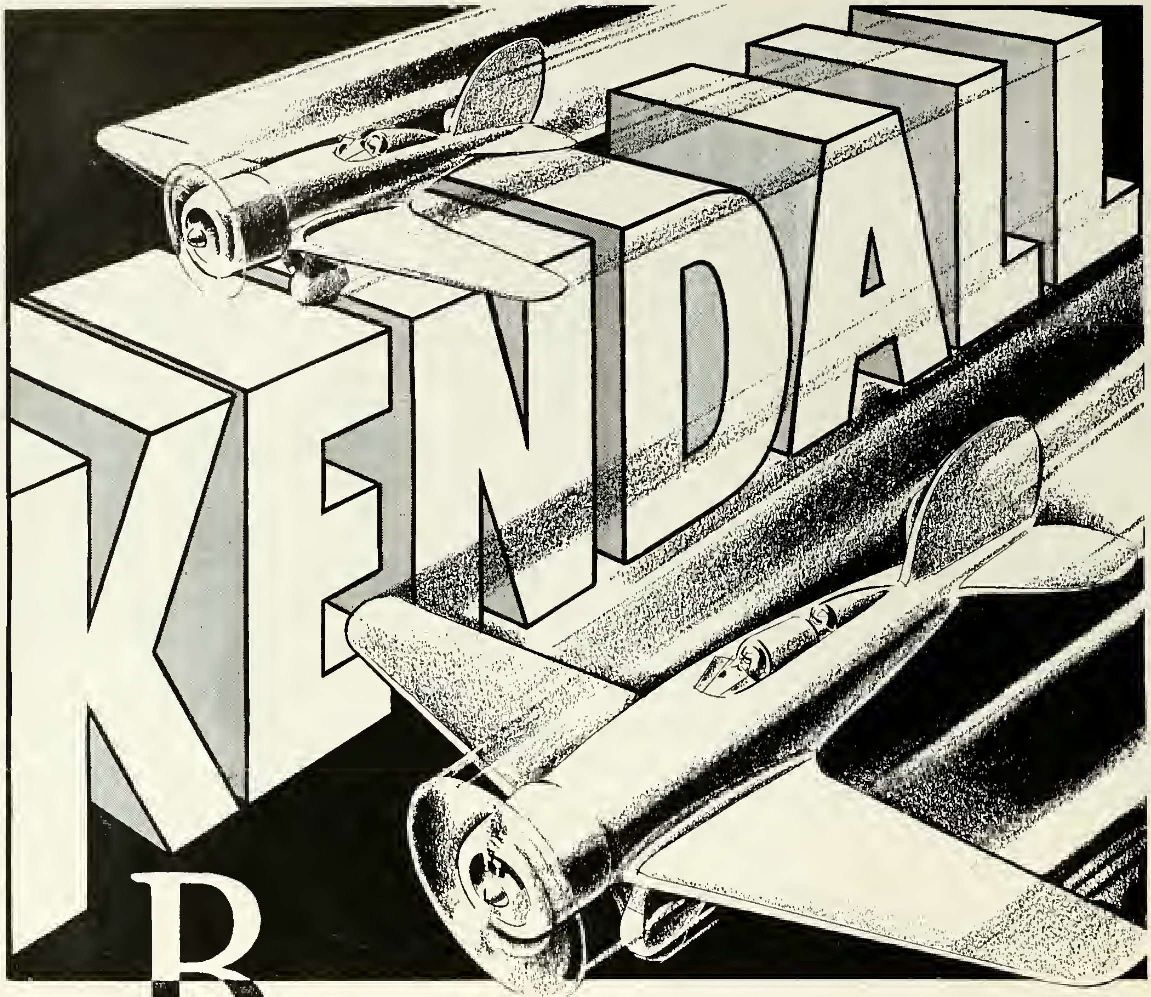
Aero Digest, *January, 1935*
Volume 26. Number 1.
Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly subscription, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879.



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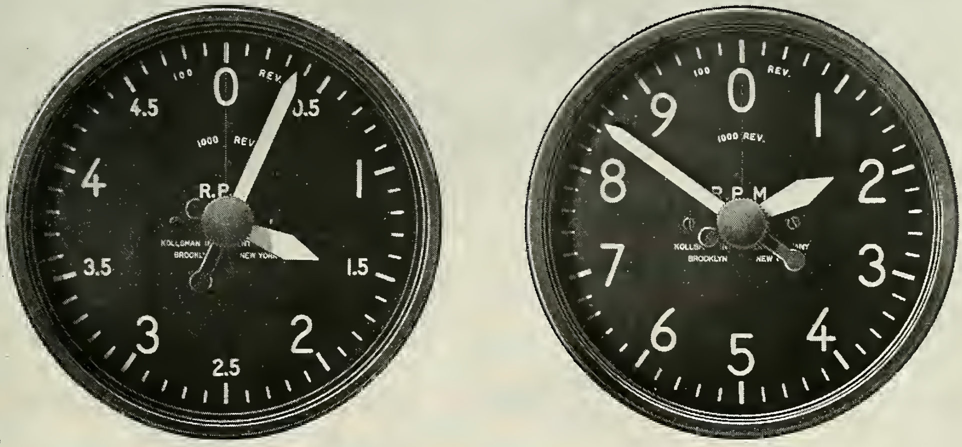

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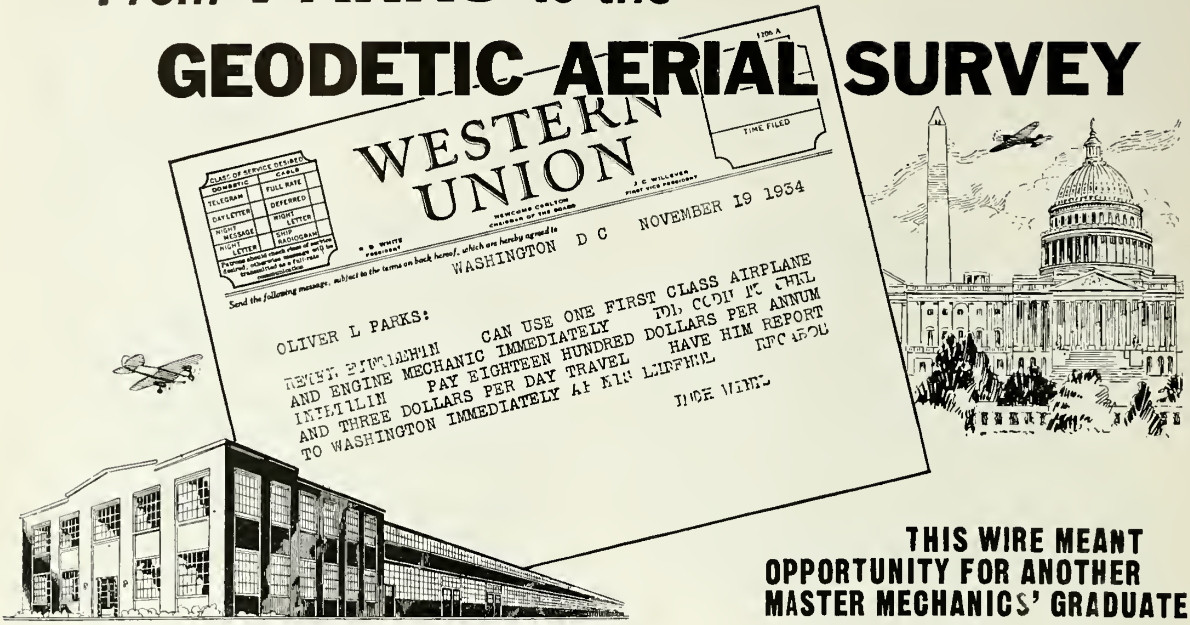

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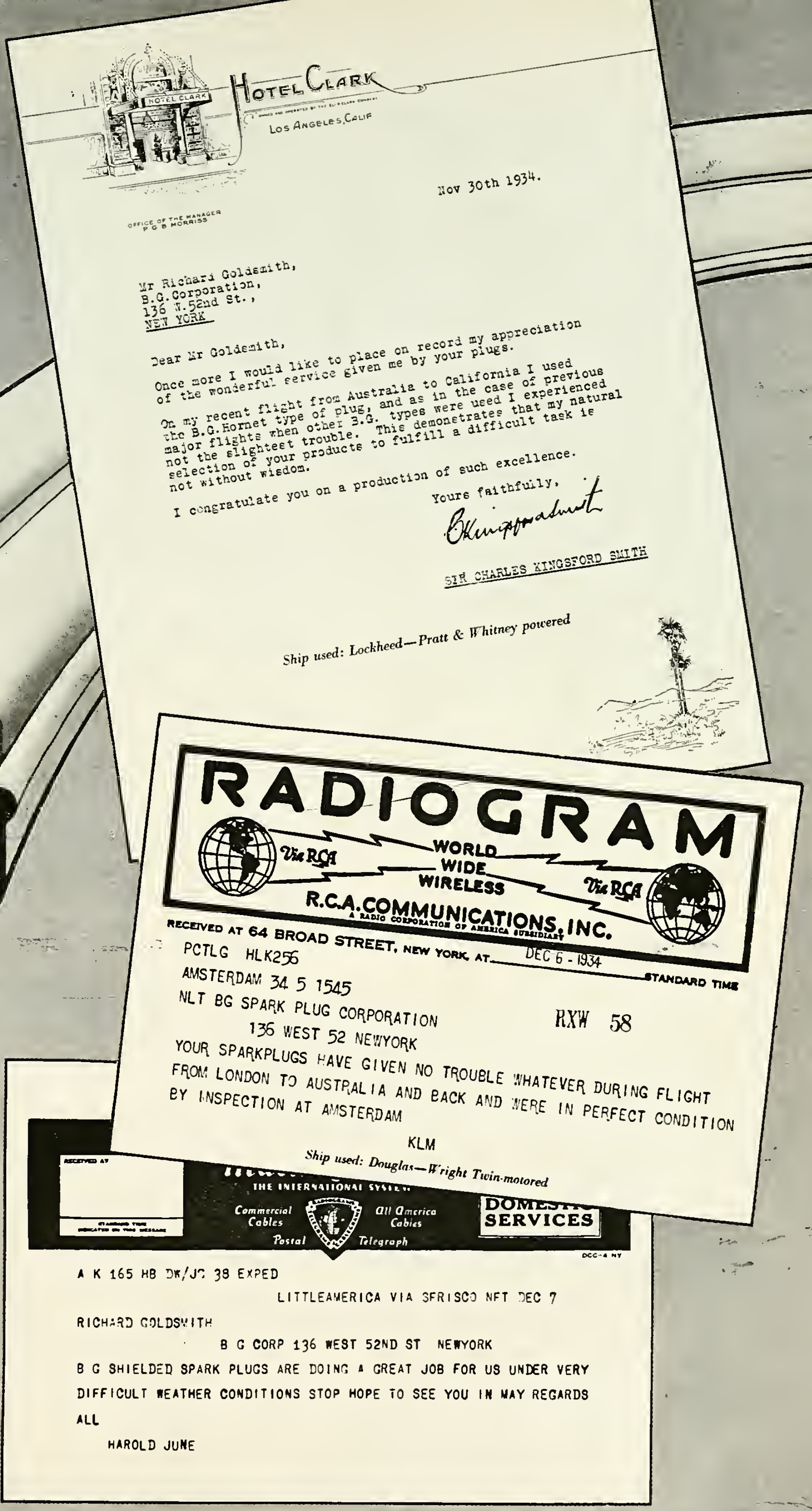

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Nov 30th 1934.

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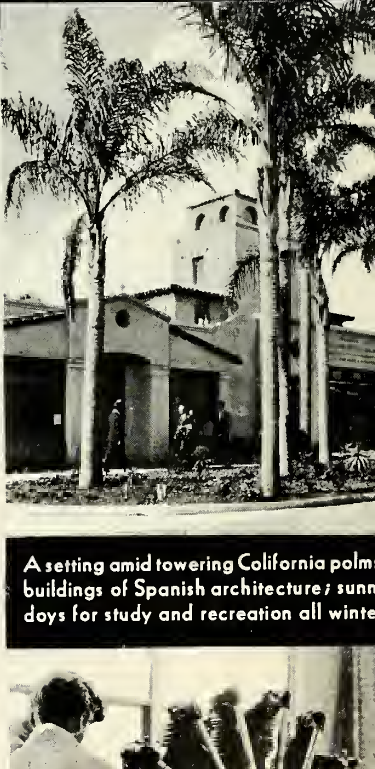

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VOLUME TWENTY-SIX NUMBER ONE

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Martin Flying Boat for The Pan American Airways, powered by four P. & W. 800 h.p. Double-row Wasp Engines

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Recent Activities of Our Naval Air Service

●

REAR ADMIRAL ERNEST J. KING

Chief, Bureau of Aeronautics, U. S. Navy

● Experience has shown that in order to produce satisfactory service aircraft, an orderly, continuous, and progressive experimental development program is essential. Such a program has been carried out, to the limit of funds available, by the Bureau of Aeronautics in the fiscal year ended June, 1934, not only in the matter of airplanes and engines, but also in the related fields of equipment, instruments, armament, radio, basic materials, aerodynamics and ships' installation for carrier launching and arresting, and seaplane launching and recovery devices and apparatus.

In the matter of service aircraft, the Bureau has provided, in so far as available funds permitted, airplanes of approved types, and in accordance with approved type complements which embody the latest and most important developments in the state of the art. Of particular importance has been the increase in speed range of our latest types. By the use of the controllable pitch propeller and the various devices for decreasing landing speeds it has been possible to raise considerably the high speed of new service types and at the same time to keep landing speeds down to required limits.

Through PWA allocations, the Bureau has been enabled to undertake a practical program of modernization of aircraft already in existence. This program, started in the Fall of 1933, is well on its way to completion and is confidently expected to result in a great improvement in the efficiency and usefulness of existing models.

The greatest step forward in the development of Naval aviation taken by the government during the year lay in the passage of the Vinson-Trammell Act which authorizes the procurement of Naval aircraft in numbers commensurate with the strength of the "Treaty Navy" in surface ships. To provide an adequate and proportionate aviation arm of the Navy, a five- to seven-year building program has been laid down providing approximately 1910 airplanes by 1940-1942

Funds to carry out the first year of this new program are now available. Upon completion of the first year's program the Navy will have 1193 airplanes. Funds will be requested in the 1936 budget for the second year's program, 273 airplanes, to provide aircraft complements for the two new carriers: *Yorktown* and *Enterprise*, and six new cruisers.

Constant effort is being made to improve the characteristics of Naval aircraft, particularly in regard to speed, range, and striking power. Vigorous prosecution of an experimental development program for aircraft and engines will be continued.

Continued development of the employment of long-range patrol bombing squadrons is expected. Future plans involve the service tests of larger seaplanes of this type, with increased range, bomb loads, and speed.

It is desired to increase the striking power of the carrier-based scouting class airplanes by including arrangements for dropping heavy bombs in diving attack. The development of such an airplane is now underway.

Aircraft in accordance with approved type complements in sufficient numbers should be provided for (a) replacements required by obsolescence and crash losses, and (b) increases distributed over a period of five to seven years to make the Naval aircraft strength measure up to the Treaty Navy (estimated 1910-2150 airplanes) as authorized by Congress.

Among the more important accomplishments of the year were (a) conduct of the experimental development program of aircraft, engines and accessories, and of the research activities connected therewith; (b) provision of new service aircraft of approved modern types in accordance with the requirements of the Navy; (c) establishment of new aircraft type complements for carriers, with a view to increasing the striking power of this arm of the Fleet; and (d) preparation and submission of a tentative program for increasing the strength of Naval Aviation in accordance with the authorization contained in the Vinson-Trammell act.

The Bureau has recommended to the Navy Department action on the following matters (a) provision of personnel required by the prospective increases in the Naval aeronautic organization; (b) modernization of the aircraft carriers *Lexington* and *Saratoga* as to bomb and torpedo stowage, and handling; (c) improvement in airplane handling equipment on all classes of ships carrying aircraft; (d) provision of adequate tender facilities for patrol class aircraft; (e) rectification of unsatisfactory conditions at shore stations as required by the Depart-

Navy patrol flying boats in formation, dropping bombs

ment's shore development program; (f) construction of proposed Margarita Breakwater at Coco Solo, C. Z.; and (g) increased shore facilities to care for projected increases in the Naval aeronautic organization.

The 1934 appropriation act carried authority to enter into contracts for replacement aircraft necessary to maintain the 1000-airplane program to the value of $8,100,000, but limitations prescribed by the Bureau of the Budget reduced the amount that could be so obligated to $2,400,000. As this authority to enter into contracts for new airplanes extends to July 1, 1935, the $5,700,000 remaining under this contract authorization is available for obligation during the fiscal year 1935, and the amount carried in the 1935 appropriation for contract authorizations was reduced accordingly.

Patrol Squadron 5-F, in delivering new aircraft to Coco Solo via air made a nonstop flight from Norfolk to the Canal Zone which constituted the longest nonstop, non-refuelling formation flight on record at the time.

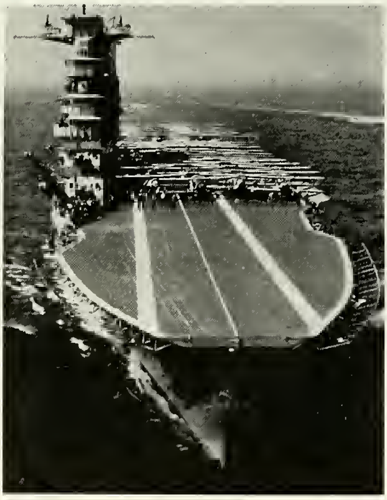
Patrol Squadron 10-F in connection with the routine transfer of aircraft from Norfolk to Pearl Harbor, flew from Norfolk to Coco Solo by stages, thence to Acapulco, Mexico; San Diego, Caiif., to San Francisco; and thence to Pearl Harbor, in formation, the latter flight constituting the longest formation overseas flight on record.

During the fiscal year 1934 the policy of ferrying new and overhauled aircraft was extended to include practically all deliveries of aircraft to operating units by this means. In this connection, 269 transcontinental flights have been made with new and overhauled aircraft.

Lighter-than-air activities during the year were governed by the general policy of operating the U.S.S. *Macon* in conjunction with the Fleet to determine the utility of this type of airship to the Fleet.

Noteworthy progress has been made in the matter of operating airplanes from airships of the *Macon* type.

The Naval Air Station, Lakehurst, has been placed on a reduced status, but is still maintained as a station for training of personnel and for limited operations, using the metal-clad ZMC-2 and nonrigid K-1.


Bow view of the U.S.S. Saratoga

Rigid airship development should be continued as well as the development of tactical and strategic employment of rigid airships as active units of the Fleet. One ZRS should be constructed to replace the *Akron* and one ZRN built to replace the *Los Angeles* for this purpose.

U.S.S. Macon in flight over its hangar at Sunnyvale, Calif.

The program of providing facilities for airship operation has continued by the maintenance and development of adequate facilities for mooring and servicing airships at Guantanamo Bay, Cuba, Miami, Fla., and Ewa, Hawaii, as well as Lakehurst and Sunnyvale, Calif. Mooring facilities at Panama and improved mooring facilities in northwestern United States should be obtained and the employment and procurement of non-rigid airships examined and considered.

As of July 1, 1934, the Naval Aeronautic Organization was short 167 aviators, heavier-than-air, of the regular Navy. Provision should be made for the required increases in personnel.

At the close of the fiscal year 1934, regular Naval personnel on duty in connection with naval aviation activities consisted of 1,437 officers and 11,973 enlisted men as follows:

	Officers	Enlisted Men
Pilots	834	306
Student pilots	107	—
Observers	5	—
Flight orders	2	1,572
Non-flyers	489	10,095

At the same time, Marine Corps aviation personnel on duty consisted of 128 officers and 972 enlisted men, of whom 138 were classed as pilots.

Aviation training stations and aviation service schools were maintained and operated jointly by the Bureau of Navigation and the Bureau of Aeronautics at Pensacola, Fla.; at the United States Naval Academy, Annapolis, Md., where all midshipmen are given an indoctrinal course in aviation, and at Lakehurst, N. J., where the allocation of officers to lighter-than-air training is made to suit the requirements of the service. The length of the course is one year, being modified as opportunity for flight operations in the rigid airship permits.

Flight operations during the period under review for the U. S. Navy, Marines, Naval Reserves and Lighter-than-Air consisted of 208,987 flights (not including glider flights) for a total of 225,614 hours.

Training of Naval and Marine Corps reserve personnel was performed on a reduced basis due to the drastic reduction in training funds. Ground training was accomplished largely at voluntary drills, and it is believed the personnel of Naval and Marine Corps Reserve Aviation deserves commendation for the high state of morale and manner of carrying on under adverse conditions.

No students were trained and no funds were provided for the flight training of any Volunteer Reserve aviators. If denial of annual flight training for this class is continued, officers composing it will cease to be aviators and this loss will be serious. The urgent need for more qualified officers and enlisted men in the Naval and Marine Corps Reserve still exists. There was no Reserve student training conducted during the fiscal year 1934.

The policy previously inaugurated of paralleling the 150-hour endurance tests of each new engine by accelerated service tests of 150-hour flight time during which the engine is subjected to all prospective service types of operation, has been continued as fully as practicable. This form of testing has permitted early discovery and correction of power plant defects not ordinarily disclosed in test stand running or routine flight trials, and has resulted in a reduction of service difficulties with new type equipment at a corresponding saving in cost and delay.

Increased reliability and durability, and reduction of maintenance costs, has been furthered by continuing the policy of periodically subjecting overhauled engines from various bases to the regular 150-hour endurance tests, similar to that required for new engines.

Experience during the past year has disclosed a gratifying improvement in the recently developed two-row radial engine as a service type. Further exploration of its inherent possibilities for increase in power without increase in displacement has continued to yield important gains. Developments and improvement of service-type single-row radials has been carried on simultaneously with the two-row type with comparable increases in performance. Extensive test work at the Naval Aircraft Factory has been concerned primarily with simplification of fuel systems, improvement of carburetor design as affects fuel flow, and investigation of mounts and cowling. Important progress has been made in the principal problems in the new-type field, namely, improved altitude performance, fuel injection and safety fuel, valve improvement, and large displacement engines. The airship power plant program, leading to the installation in U.S.S. *Macon* of engines of domestic design and manufacture, is being rapidly completed.

Controllable-pitch propellers have been developed for several classes of airplanes, including patrol, scout and fighter.

Continued progress has been made in the development of service types and this progress should be maintained by improvement of types through a balanced airplane, engine, accessory and materials program. The past year has witnessed the placing in service of planes of considerably advanced performance, particularly in the field of two-seater fighters, single-seat fighters and scouting planes. Additional experimental designs have been brought out, principally around the two-row radial engines and the next fiscal year will see further advance.

U. S. Navy scouting wing of 30 planes passing in review

The Naval Air Station, Anacostia, has continued to carry out the flight testing of new airplanes. Arresting, night flying, rough water and accelerated service tests are conducted at Norfolk. Bombing and diving tests are done at Dahlgren, and catapulting at the Washington Navy Yard. The Naval Aircraft Factory has continued to serve as a station for testing materials, structures, engines, catapults, anchors and developing specifications and standards and manufacturing experimental parts and installations.

Fighting planes of the airship Macon

One of the larger air station projects developed is that at Corry Field, Pensacola, Fla. This project provides complete permanent facilities for housing and servicing aircraft, an administration building, barracks and mess hall for enlisted personnel, etc. The Bureau has also undertaken many necessary items of repairs, maintenance, and rehabilitation.

The practice of leasing outlying flying fields in the vicinity of San Diego, Pensacola, and Norfolk is being continued and the need of most of the fields will continue for an indefinite period. Steps should be taken to purchase some of the most desirable and necessary of these fields.

At most of the Naval Air Stations and Fleet Air Bases a large number of temporary wartime constructed buildings and structures are of necessity still in use. This situation prevails in particular at Pensacola, Coco Solo, Pearl Harbor, Norfolk and Quantico, and projects for replacement in permanent construction should be undertaken at these and other places in accordance with approved departmental plans.

Unsatisfactory seaplane operating conditions arising from the rough water in Manzanillo Bay are prevalent at the Fleet Air Base, Coco Solo, and improvement can only be secured through the completion of the Margarita Point breakwater.

In performing its varied functions the Bureau is guided by the cardinal principle of maintaining the forces afloat in a condition of readiness for war in accordance with the Operating Force Plan. Of primary concern is the matter of providing material which is reliable, which is modern, and which is equal or superior to that produced and provided by foreign powers. The Bureau feels that during the past year it has, in a great measure, met this obligation and is upheld in this opinion by the reports of various Congressional committees which have inquired exhaustively into the subject.

U. S. Marine planes on their flight from Nicaragua to Washington

AIR
Hot and Otherwise

FRANK A. TICHENOR

● Who is running the Government of these United States — the President or the Postmaster General? There ought to be a showdown. The people of America have a right to know whether the man they elected to the highest office of the land, or the Donkey's chief political puppet-puller, is really the head man of this Administration.

However much we may have criticized some of the President's policies, we have always believed him to be a man who made his own decisions and controlled the actions of his own subordinates. We still want to believe that of him. But it is getting more difficult to do so—because the Jobmaster General has defied him and gotten away with it.

Last month, we pointed out that Call-me-Jim Farley had not then appeared before the Federal Aviation Commission even though it was he who had so churned up the aviation seas that the President had to send out the SOS which resulted in the appointment of the Commission. He has not taken the witness stand before that body even yet. But the worst part is that the Commission must have asked him—undoubtedly even urged him—to testify, and he apparently declined.

As if such defiance were not enough, the Postmaster General now apparently threatens to triple his treason. He is reported to have said that, no matter what recommendations the Federal Aviation Commission makes, he will "vigorously oppose" any legislation which doesn't jibe with his present notorious "bargain" air mail set-up.

It is already generally accepted that the Commission will recommend a fairer, more just air mail arrangement. It has listened to all sides of the question; it has weighed the facts; and it has sifted out the wild fancies. And after doing so, it has come to the conclusion that Farley's raw deal means a slow, torturous death to America's leadership in scheduled air transport.

Yet despite the fact that the President appointed these men for the specific purpose of studying and ascertaining these things, despite the fact, too, that Congress appropriated funds for them to carry on this work, this one man has the effrontery to imply that he—and only he—has the right to determine what the Government's air mail policy shall be. If he had had the common decency to give the air mail contractors a fair trial in the beginning, if he had had the courage to stand up and present his evidence later, you might admire him as a man who sticks to his guns for a cause that he thinks is right. But no—by legal subterfuge, he avoided giving the contractors the hearing due them; and with ill-mannered cowardice—what else can it be?—he hid behind the eminence of his office to escape appearing before the Federal Aviation Commission.

Within the next few weeks, the President will have to choose. He will have to decide whether his Commission or his Jobmaster General shall have the White House's support on the question of air mail legislation in the new Congress. If he stands by the Commission, then he will do the honest, the courageous thing, and he will demonstrate that it is he who runs the Government. But if he submits to Farley, then Farley not only will have successfully defied the President, he will have triumphed over him. Political intrigue will stand above justice in America!

* * *

As the foregoing paragraphs have suggested, the Commission has just about finished up its job, and will probably hand in its official recommendations the first week in January. So perhaps it's not too early to take a brief look at its off-the-record record.

One thing is obvious, and lamentable—there have been too many Greeks bearing gifts to the Commission, and too many of them have gotten past the guard at the door. Little cliques and groups have been trying to cut the throats of other groups and cliques because they imagined they stood in the way of their own petty ambitions and greed. You may not have heard much about these activities because this breed always works under cover—never in the open. But they've been in there just the same, scrambling after pennies, ever since the Commission was appointed, and they haven't hesitated to kick and claw and otherwise deface the reputation of their so-called adversaries.

The worst part about it—yes, the disgraceful part—is that some of them seem to have succeeded in reaching some of the Commissioners. Result:—The Commission has been ridden with internal politics which for a time threatened serious damage to the formulation of a well-balanced and thoroughgoing national aviation policy.

If rumors are to be trusted, the Commission's recommendations are going to be somewhat lopsided. The air mail policy it will likely suggest is apparently sound and constructive. Its probable recommendations for the building up of the Army and Navy air arms are eminently to the national interest. BUT apparently it will ignore private flying completely despite the fact that private flying holds the key to a tremendous aviation expansion. AND it will ask that a percentage of the future military and naval aircraft be designed and manufactured by the Government.

Both of these flies in the ointment are poison in the cup of American aeronautics. Years ago the Lampert Committee and the Morrow Board both tasted and tested the idea of Government aircraft production in competition with private manufacturers and both found it bad for the national defense digestion.

Likewise, so long as the Government fails to recognize and encourage private flying, just that long does it weaken its efforts toward creating a strong backbone of national defense in civil aeronautics. We need not go into the subject completely here—it ought to have been obvious to the Commission that the few planes and pilots used in scheduled air transport are not enough to create a manufacturing and personnel reserve adequate for a national emergency, and that miscellaneous commercial aviation cannot survive if it goes on selling to itself. A great growth of private flying is needed as supplement and complement to these two.

Indeed, the logic of these things is so apparent that there is nothing to believe but that the Commission was more or less influenced by the caterwauling of self-seeking groups—perhaps even to the degree that some of its own members have allowed personal ambitions to crowd out sound, impartial thinking. At the start, AERO DIGEST warned against these dangers, warned that some of the commissioners would be the object of villainous wooing because of their unfamiliarity with the currents and cross-currents now moving in aviation, warned that the play of personal ambitions could maim the work of the Commission.

So far as we have been able to ascertain, however, at least one commissioner did both overcome the handicap of his knowledge of aviation and at the same time kept ambition subdued. But then, he is a true son of his father, and his father distinguished himself as a member of a President's cabinet by his consistent independence and intellectual honesty. If there is to be a permanent aviation commission, let it be comprised of men like him.

EDITORIALS

"About 66% of the cost of aircraft construction and 75% of the cost of aircraft engine construction is for labor. In 1933, aeronautical exports provided 10,620,000 man hours of labor. With proper cooperation on the part of the Government this could be increased to 100,000,000 man hours within a few years."—THOMAS A. MORGAN, President, Curtiss-Wright Corporation.

All First-Class Mail By Air

● Right now American air transport operators are fighting for their existence, being placed in their present economically embarrassing situation by uninformed and meddling government executives. England meanwhile is making extensive plans to build-up and encourage the growth of its airlines to the point where they will eventually lead the world in carrying passengers, mail and express by air.

While we sit by, American aeronautical supremacy, first in military, then in private and finally in commercial activity goes to foreign shores, and England prepares for the stabilization of what it considers its greatest enterprise—the aviation industry.

Only last month, Aero Digest called attention to a new British internal air mail policy by which all first-class mail was sent by air, without extra charge. Now we report that as a result of many months of cooperative work by the Air Ministry, the Post Office Department and Imperial Airways, there will be (1) a material improvement in time schedules throughout the empire; (2) a substantial increase in the frequency of services; and (3) *the carrying by air at regular mail rates of all first-class mail to empire countries reached by present or projected air services.* Our italics are quite self-explanatory.

For years Aero Digest has advocated first-class mail by air at regular rates. The fact that Great Britain has laid the groundwork for such a service indicates only the backwardness of American aviation and reflects the objectionable practices of our policticaily-controlled and lobby-swayed legislatures.

Once again, while we watch, somebody else has taken the initiative.

Black-balled For Loans

● The greatest portion of the aviation business is out in the cold. After months of diligent effort, it finally has been disclosed by the RFC that only manufacturers are entitled to make application for loans.

Like many other deductions made by the incumbent government, those rulings pertaining to the other phases of the industry are objectionable and prejudicial. It has been held that air transport companies, no matter how good their collateral, can not secure a loan because, according to the RFC's legal department, the Congressional act limits their action to loaning money to railroads. Schools are out because an aviation school is ruled to be the same as a school or university, which are ineligible. Airports and the rest of the business are also tabooed because they are classified as a service enterprise, and the RFC policy is opposed to loaning to service enterprises.

If these rulings were not bad enough, it suddenly is discovered that every bit of help extended to aviation has been stopped pending the Federal Aviation Commission's report. The net result is that today nobody engaged in American aeronautics can, temporarily at least, get needed capital to continue business if such aid is necessary.

After what the government already has done to injure aviation, it is inconceivable that this latest effrontery is being foisted on an industry that looms greater each day as the country's only salvation in any conflict between nations.

It is time these underhanded tactics were terminated. Something must be done to save the industry from political intrusiveness. If the Federal Aviation Commission does not have the solution, what is to become of American aeronautics?

Time for an Aircraft Show?

● Few of the shows which preceded it have equalled in interest the Fourteenth Aviation Exhibition held in the Grand Palais des Champs Elysées, Paris, where more than seventy military and commercial airplanes were shown by practically every major manufacturer in Europe. Enthusiasm ran high, for it was two years since the last show was held and the exhibits indicated that the time had profitably been spent in consolidation, rather than experimentation.

A similar situation exists in this country, except that we have been without an aircraft show for more than two years, and, if present indications mean anything, will not have another soon.

We have made tremendous progress in our aircraft, in our engines and our accessories and the public, the potential user of these products, should be accorded an opportunity of learning, first hand, exactly what we have accomplished.

When official investigations have ceased, when we are left without stupid interference to conduct our business without the hazards of government meddling, then it would be time for a revival of our All-American Aircraft Show. What we have to disclose will awaken a public to the immensity of modern aviation.

Keeping America At the Peak

● Something more than hope for personal gain has prompted Pan American Airways to place orders for more than a million dollars worth of new aircraft.

The maintenance of America's supremacy over the commercial air routes of the world (in the face of repeated and energetic efforts by the English, French, German and Italian interests to wrest that leadership from us) has been the desire of that company ever since it gained recognition as the longest and finest international airline in existence. It has carried our flag and our commerce to almost every country in South and Central America, in China and in Alaska. And, even now it is setting the stage for a trans-Atlantic and trans-Pacific service.

It is consoling to feel that nationalistic pride is proving a greater stimulus than financial gain, at least in so far as Pan American Airways is concerned. Its efforts in keeping our aircraft factories at work and in keeping American aviation at the peak of international air commerce should receive the hearty approval and encouragement of every far-sighted and enterprising American.

Using "home products" in the form of aircraft, engines, and accessories, Pan American Airways has an infinitely better chance of achieving its goal than any foreign line. That is if the contemplated investigation of its air mail activities by Senator Hugo Black does not raise as much havoc with it as it did to our domestic lines. Pan American Airways is an institution which cannot be equalled in the world. It has fostered good-will in South America and provided American business with an imposing advantage over foreign competitors. To undermine such an enterprise would be another blot on the already mud-smeared escutcheon of our government.

Chronology of Some Important Events of 1934

● The year 1934 was one of unusual aeronautical activity. Several new records were established in the United States and abroad and many evidences of technical advances were recorded each month. Noteworthy speed, distance and altitude flights claimed the attention of the world. The following digest of aviation events, which includes only a cross-section of the more outstanding occurrences, will serve to show the general trend of aeronautical progress during the past year.

January • U. S. Navy Squadron VP-10F flies to Hawaii, non-stop

January

The four-motored Latécoere seaplane *Southern Cross* with a crew of five flew from Berre, France, to St. Louis, Senegal, setting a non-stop seaplane flight record of 2,666 miles and then flew 2,010 miles across the South Atlantic in 18 hours 17 minutes. (Jan. 1)

A new landplane speed record for a 1000-kilometer course was set by M. Massotte who flew the Istres (France) race course in 2 hours 47 minutes 31 seconds, averaging 358.2 kilometers an hour in a Regnier Gipsy-powered Caudron. (Jan. 7)

Postmaster General James A. Farley ordered all air mail contracts cancelled. (Jan. 9)

U. S. Navy Squadron VP-10F made a 2400-mile non-stop formation flight in six Wright-powered Consolidated flying boats from San Francisco to Hawaii in 24 hours 45 minutes. (Jan. 10-11)

The Sixth Annual All-American Air Races were held at Miami, Fla. Jack Wright broke the world's speed record for light cabin planes (with passenger) flying 167.482 miles an hour over a 100-kilometer course in his Warner-powered Monocoupe. (Jan. 11-13)

Giovanni Zappetta broke the altitude record for planes of the third category, flying his Nuvoli N5, Pobjoy-powered plane to 24,288 feet. (Jan. 15)

Lee Miles flew a Miles Special monoplane to a world's speed record for planes of its type over a 100-kilometer course at a speed of 209.11 miles an hour at Miami, Fla. (Jan. 17)

Commander Francia Lombardi, Count Franco Mazzotti, Davidi Guilini and Mario Battaglia flew a tri-motored Piaggio-Stella-powered Savoia-Marchetti S-71 from Rome, Italy, to Casablanca, Morocco; Dakar, Senegal and then across the South Atlantic to the Brazilian coast where they were forced down near Rio de Janeiro. (Jan. 27-29)

February

Pavil Fedoseinko, Andrey Vasenko and Ilya Usyskin ascended to an altitude of 72,178 feet over the U.S.S.R. in their stratosphere balloon. They were fatally injured in landing. (Feb. 2)

A mail plane from Brazil landed in Berlin, Germany, after flying 5,700 miles in 3 days 8 hours 40 minutes and stopping in mid-ocean at the steamship *Westphalen,* at Bathurst, Africa and at Seville. Spain. (Feb. 12)

Shushan Airport, New Orleans, La., was dedicated and the Pan American Air Races were held concurrently. James Wedell set a record for landplanes, flying 100 kilometers at 266 miles an hour and S. J. Wittman flew a Wittman Special over the same course at 137.5 miles an hour for a record in its classification. (Feb. 14-17)

The U. S. Army Air Corps took over operation of air mail routes formerly flown by commercial operators. (Feb. 19)

Capt. E. V. Rickenbacker flew a Douglas transport, powered by two Wright Cyclone engines, from Los Angeles to Newark, N. J., in 13 hours 4 minutes, a transcontinental record for transport planes. (Feb. 19)

March

American and Russian aircraft were employed to rescue a party of 101 persons from the ice in the Arctic Ocean near the Bering Strait where the steamer *Chelyuskin* was marooned. (Mar. 5)

Marsye Hilz completed her second Paris-Tokyo solo flight when she landed at Haneda Airport in a Hispano-Suiza-powered Breguet. (Mar. 6)

A TWA Douglas airliner flew from Chicago to New York in 3 hours 10 minutes, at 236 miles an hour. (Mar. 7)

Capt. Corniglion-Moligner and Andre Malraux, aerial explorers, reported the

February • Shushan Airport, New Orleans, La., largest and most modern field in the South, dedicated

March • Laura Ingalls completes 16,000-mile solo flight

April • Commander Donati establishes world's altitude record

discovery from the air of the Queen of Sheba's lost city in Asia Minor. (Mar. 9)

Laura Ingalls flew solo across the Andes Mountains between Santiago, Chile, and Buenos Aires, Argentina, while on an aerial tour of South America, the first American woman to accomplish the feat. (Mar. 21)

April

Capt. Janusz and Lieut. Warzak in a balloon of 750 cu. meters capacity remained aloft over Warsaw, Poland, for 26 hours 45 minutes, a world's duration record. (April 3)

Four Luft Hansa airplanes, in relay, with the steamship *Westphalen* in mid-ocean as a refueling base, flew from Pernambuco, Brazil, to Stuttgart, Germany, 5500 miles, in 2 days 23 hours 45 minutes, cutting almost 12 hours from the previous record over a similar course. (April 9)

Commander Renato Donati flew a specially constructed Caproni biplane to a world's record altitude of 47,340.25 feet at the Montecelio flying field near Rome, Italy. (April 12)

A transcontinental record for lighter-than-air craft was established by the U.S.S. *Macon* when she completed a flight from Sunnyvale, Calif., to Miami, Fla., in 54 hours. (April 22)

Laura Ingalls completed the first solo flight around South America in her Lockheed and flew back to the United States. Her entire trip totalled 16,000 miles. (April 25)

Capt. Boris Sergievsky flew the Pan American Airways Sikorsky S-42 flying boat to an altitude record (with load) when he ascended 16,000 feet with a load of 16,500 pounds over Bridgeport, Conn. (April 26)

Marsye Hilz completed her second round-trip flight between Paris and Tokyo, 18,750 miles, and flew between Saigon, Indo China, and Le Bourget Field, Paris, in 5 days 9 hours 5 minutes. (April 28)

May

Bernard Rubin and Kenneth Waller flew a de Havilland *Leopard Moth* from Australia to England in the record time of 8 days 12 hours. (May 1)

Col. Roscoe Turner flew between Detroit, Mich., and Pittsburgh, Pa., in 48 minutes 19 seconds, averaging 329 miles an hour in his special P. & W.-powered Wedell-Williams racing plane. (May 3)

American Airlines inaugurated sleeper-plane service between Dallas, Fort Worth, Tex., and Los Angeles, Calif., using Wright Cyclone-powered Curtiss-Wright Condors. (May 6)

Commercial operators resumed flying the mail, taking over operations from the Army Air Corps and working under new contracts and revised rates. (May 8)

Col. Roscoe Turner flew between Detroit, Mich., and New York, N. Y., a distance of approximately 550 miles, in 1 hour 47 minutes 21 seconds with his special P. & W.-powered racer. (May 11)

Jack Frye flew a cargo of mail from Los Angeles, Calif., to New York, N. Y., in 11 hours 31 minutes in a Wright Cyclone-powered Northrop. (May 13)

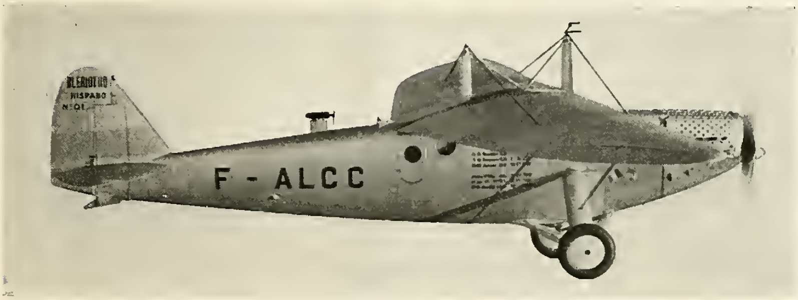
George R. Pond and Cesare Sabelli flew from Floyd Bennett Field, Brooklyn, N. Y., to Lahinch, Irish Free State, in the Wright-powered Bellanca *Leonardo di Vinci,* in an attempted flight to Rome, Italy. The flight took about 32 hours. (May 14-15)

Capt. Boris Sergievsky established a world's altitude record for seaplanes with a 5000-kilogram load by flying the Pan American Airway's Sikorsky S-42 flying boat to 21,800 feet in tests over Bridgeport, Conn. (May 17)

Jean Batten flew her Gypsy Moth from England to Australia in 15 days 23 hours 25 minutes. (May 23)

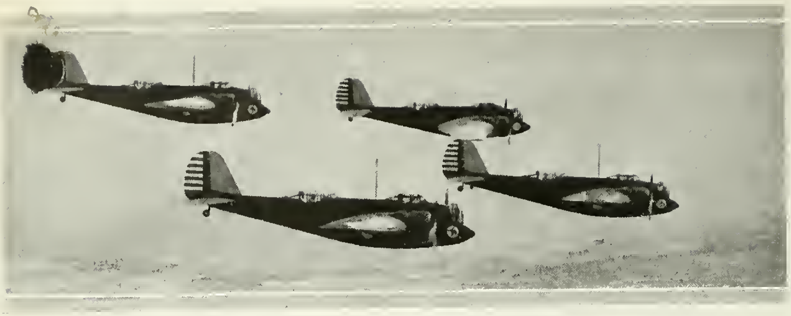
Raymond Delmotte set a world's speed record by flying over a 100-kilometer course from Villesauvage to La Marmagne, France, in 13 minutes 54 seconds, averaging 268.07 miles an hour. (May 24)

Col. Roscoe Turner flew between Pittsburgh, Pa., and Chicago, Ill., 400 miles, in 1 hour 43 minutes, averaging 228 miles an hour in his P. & W.-powered racer. (May 26)



May • Codos and Rossi cross Atlantic in Bleriot monoplane

June • Collier Trophy awarded to Caldwell of Hamilton Standard Co.



July • **Army flies Martin bombers in formation to Alaska from Washington**

Paul Codos and Maurice Rossi flew non-stop from Paris, France, to Floyd Bennett Field, Brooklyn, N. Y., in their Hispano-Suiza-powered Bleriot monoplane, *Joseph Le Brix,* in an effort to establish a new world's long-distance non-refueling record. (May 28)

June

The Collier Trophy was awarded to the Hamilton Standard Propeller Company, E. Hartford, Conn., for the development, by Frank W. Caldwell, its chief engineer, of the controllable-pitch propeller. (June 1)

The Fifth Annual National Soaring contest began its 16-day session at Elmira, N. Y. (June 23)

The Third Annual Annette Gipson All-Women's Air Race, a 30-mile closed course event, held at Roosevelt Field, Garden City, Long Island, N. Y., was won by Edna Gardner from a field of twelve entries. (June 24)

Richard du Pont established a world's distance record for motorless flight in his Bowlus-du Pont sailplane by soaring from Elmira, N. Y., to Somerset, N. J., a distance of 155 miles. (June 25)

Richard du Pont set an American altitude record for gliders when he reached 6,224 feet in his Bowlus-du Pont sailplane at Elmira, N. Y. (June 30)

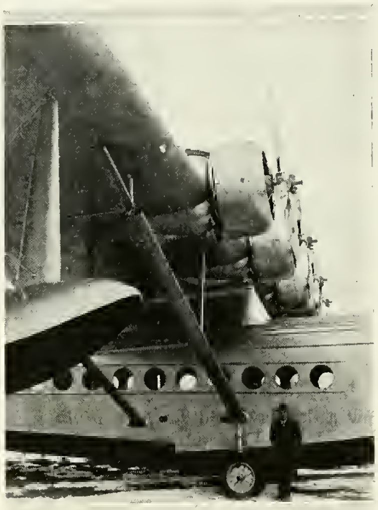
July

Benjamin and Joseph Adamowicz flew from Harbor Grace, N. F., to Flens de Lorne, France, in their Wright-powered Bellanca, in attempting a non-stop flight to Warsaw, Poland. (July 1)

American Airlines inaugurated sleeper-plane service between Chicago, Ill., and New York, N. Y., using Wright Cyclone-powered Curtiss-Wright Condors. (July 9)

Lieut. William G. Tomlinson, U.S.N., flew a Grumman SF-1 scouting plane, powered by a Wright Cyclone engine, from the Naval Air Station, Anacostia, D. C., to San Diego, Calif., in 15 hours. (July 10)

Twelve Navy Consolidated flying boats and 10 Army Air Corps Martin bombers took off for formation flights to Alaska, the Navy planes starting from San Diego, Calif., and the Army planes from Washington, D. C. (July 20)



August • **Sikorsky S-42 breaks eight seaplane records**

Wolf Hirth made a soaring flight of 223.5 miles, from Wasserkuppe to Goerlitz, Germany, setting a world's distance record. (July 27)

Lieut. C. H. Kendall and Lieut. H. T. Orville won the honor of representing the U. S. Navy and of participating in the James Gordon Bennett Balloon Races in Poland by piloting the Navy entry from Birmingham, Ala., to Commerce, Ga., 206.4 miles, during the American elimination contests. (July 28)

Capt. Albert W. Stevens and Major William E. Kepner, starting from Rapid City, S. D., reached an altitude of 60,613 feet in their stratosphere balloon, the *Explorer.* (July 31)

August

Mrs. Cecil W. Kenyon flew a Waco plane to an altitude of 17,500 feet at the East Boston, Mass., Municipal airport. (August 1)

TWA, Inc., inaugurated 18-hour overnight passenger and express service from New York, N. Y., to Los Angeles, Calif. The return trip is made in 16 hours. (August 1)

The Pan American Sikorsky S-42, flying with a full load, broke eight records for transport seaplanes while making her final test flights back and forth between Bridgeport, Conn., and New York City, flying for a total distance of 1,242.8 miles at an average speed of 157.5 miles an hour. (August 1)

The first American aerial mail glider train flew from New York to Washington, D. C., one of the gliders being released at Philadelphia, Pa., another at Baltimore, Md., and the third over Washington. (August 3)

The First Women's National Air Meet was held at the Municipal Airport, Dayton, Ohio. (August 4-5)

Helene Boucher flew 276.063 miles an hour over a 1,000-kilometer course at Istres, France, setting a world's speed record for women. (August 8)

James Ayling and Leonard Reid flew from Wasaga Beach, Ontario, to Middlesex, England, in the first Canada-England flight, covering 3,500 miles in 30 hours 51 minutes. (August 9)

Earl Ward and Ira Sloniger flew an American Airways' Vultee V-1A, powered with a Wright Cyclone engine, between Chicago, Ill., and New York, N. Y., in 2 hours 59 minutes 2 seconds. (August 25)

Climaxing a 15,000-mile flight through South American countries with a 1,840-mile flight in one day from Port of Spain

September • **Roscoe Turner flies across continent in 10 hours 2 minutes**

October • Scott and Black win 11,300-mile MacRobertson Race

to Miami, Fla., the Pan American Airways' Sikorsky S-42 brought Buenos Aires within five days and Rio de Janeiro within four days of Miami. (August 30)

The 1934 National Air Races began at the Municipal Airport, Cleveland, Ohio, featuring a four-day meet. (August 31)

September

Col. Roscoe Turner flew from Burbank, Calif., to Floyd Bennett Field, Brooklyn, N. Y., in 10 hours 2 minutes 51 seconds, breaking the transcontinental flight record, in his P. & W.-powered racing plane. (Sept. 1)

The James Gordon Bennett Balloon Race started from Warsaw, Poland, and was won by Z. Burznski and J. Zakrzewski of Poland, who flew approximately 750 miles. The United States' team placed sixth. (Sept. 20)

Warren Eaton and Lewin Barringer flew their soaring planes to an American altitude record of 6,500 feet over the Big Meadows, Shenandoah Valley soaring site. (Sept. 27)

James Melrose flew a Gipsy Moth from Australia to England in 8 days 9 hours. (Sept. 28)

Commander Michael Gromoff flew a Soviet RD a distance of 7,707 miles over a triangular course in Russia in about 75 hours, in a non-stop, non-refueling flight. (Sept. 29)

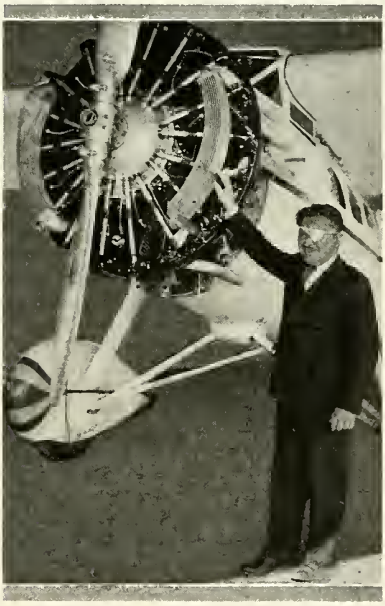
October

The Thirty-fourth Annual Conference of the Federation Aeronautique Internationale opened in Washington. (Oct. 9)

Mario Stoppani, Corradino Corrado and Amadeo Suraion flew 2,561 miles, non-stop, between Monfalcone, Italy, and Massuau in northern Africa, in a Cant Z-501 seaplane, setting a world's record. (Oct. 19)

The MacRobertson Race, between Mildenhall, England, and Melbourne, Australia, started with 20 contestants taking off. (Oct. 20)

C. W. A. Scott and Malcolm Black won the MacRobertson Race in their de Havilland *Comet* and established a speed record of 70 hours 59 minutes 50 seconds between England and Australia. The Dutch team of Parmentier and Moll took first place in the handicap race, flying a Wright Cyclone-powered Douglas, and the American team of Turner and Pangborn was second in the speed race, flying a P. & W.-powered Boeing 247-D. (Oct. 22)



December • Wiley Post seeks altitude record

Prof. and Mrs. Jean Piccard attained an altitude of 57,979 feet in a stratosphere balloon, taking off from Ford Airport, Dearborn, Mich., and landing in Cadiz, Ohio. (Oct. 22)

Lieut. Francisco Agello set a world's speed record by flying his 3,100 h.p. Fiat-powered Macchi 72 seaplane at an average speed of 440 miles an hour at Desenzano, Italy. (Oct. 23)

Sir Charles Kingsford-Smith and Capt. P. G. Taylor flew their P. & W.-powered Lockheed Altair, *Lady Southern Cross,* from Suva, Fiji Islands, to Honolulu, Hawaiian Islands, 3,150 miles, in 25 hours, enroute to Oakland, Calif. (Oct. 29)

November

Cathcart Jones and Kenneth Waller completed a round-trip flight between England and Australia in their MacRobertson deHavilland *Comet* in 13 days 6 hours and 43 minutes, a record for the 22,600-mile flight. (Nov. 2)

Sir Charles Kingsford-Smith and Capt. P. G. Taylor flew from Honolulu, Hawaiian Islands, to Oakland, Calif., in 14 hours 59 minutes, completing the third lap of their Australia-United States flight over the Pacific Ocean in their Lockheed Altair. (Nov. 4)

Capt. E. V. Rickenbacker, two pilots (Silas Morehouse and Chas. France) and three passengers flew from Burbank, Calif., to Newark, N. J., in a Wright Cyclone-powered Douglas airliner in 12 hours 3 minutes 50 seconds. (Nov. 8)

William F. Condon flew a stock light airplane (Curtiss-Wright Junior), to an altitude of 13,400 feet at Brockton, Mass. (Nov. 11)

A Pan American Grace Airways' tri-motored Ford, piloted by T. D. Jardine, reached an altitude of 26,100 feet over Peru. (Nov. 12)

Capt. Fred Nelson won the Mitchell Trophy, flying 216.832 miles an hour at Selfridge Field, Mich., a record for the competition. (Nov. 17)

Eastern Air Lines inaugurated 8-hour passenger, mail and express service between New York, N. Y., and Miami, Fla., using Douglas transports. (Nov. 19)

December

(See Digest of Recent Events, page 64)

November • Kingsford-Smith and Capt. Taylor fly across Pacific

Antarctic Interlude

●

CY CALDWELL

● We now have a National Aviation Day on the anniversary of the first flight in a powered airplane carrying a man—Mr. Orville Wright, who in his quiet way would much prefer that nobody bothered about it. On every Dec. 17, from now on, Mr. Wright will be cajoled into coming out of seclusion long enough to see his shadow and make a brief speech, which will annoy him slightly and make him wish that he'd gone in for the manufacture of canal boats instead of airplanes.

To explain the peculiar psychic adventure which now befell me, I might mention that for a month I had been ill with grippe and bronchitis, and was in pajamas convalescing before an open fire in the living room, sipping egg-nog and whiskey. I was in a weakened condition, as low in spirits as the Republican party, and when you're down like that you feel a whirling sensation in the head and hear strange noises like Senator Borah. However I was trying to think what we should feature on an Aviation Day program. How about paying an especial tribute to those noble and intrepid fellows, the Brotherhood of Polar Publicity Explorers, who have done so much for aviation by buying, crashing, or deserting airplanes, after only a couple of dozen hours' use? The thought was intriguing. Why not promote statues for such aviation heroes as Byrd or Wilkins, who deposit airplanes at either Pole and then rush home to lecture the Women's Clubs?

Well, I was thinking along like that, dully and constructively, and sipping my egg-nog, when all of a sudden I seemed to feel myself swaying slightly in my chair. Of course, I've swayed in chairs before, but this was different; I closed my eyes, feeling slightly dizzy. Dizzier than usual, I mean. As I opened my eyes again, I seemed to be seated on the deck of a ship staring at a vast expanse of ice with a little huddle of buildings down near the water. A sign on a building said, LITTLE ICE-CUBE, ANTARCTICA. "I am dreaming!" I exclaimed. "Or drunk!"

A rough voice shouted, "Little Ice-Cube—end of the line! All out!" At that a seaman rushed up, hitched a hook in the belt of my dressing-gown, there was the rattle of a winch, and in a moment I was swung over the side, landed on the ice, and the ship steamed away with a derisive hoot of the whistle.

Dreaming or not, it all looked very real to me. There on the ice was a radio mast to get out publicity, and there, beside a hut, was an airplane tied up in canvas and covered with icicles, staked down as though forever. There were also several frowsy-looking individuals slouching over toward me, looking fed-up. One of these chaps looked at me pathetically and remarked, "I don't suppose you have a rock on you? No, I suppose not. I'm a geologist, here to study rocks. And there aren't any."

"Whose expedition is this?" I asked. "There are so many down here that I've lost track of them."

"This is the base of Rear Admiral Sir Hubert Richard Ellsworth Bilkins. The Admiral himself is out back here a ways at his Advanced Weather Base."

"Could I go there on foot?" I asked. "Or do I fly?"

"Fly?" The rockless geologist laughed cynically. "We don't fly enough to get the spark plugs warm. We just shove the planes in the air occasionally, take movies of them, announce that Marie Byrd Land is bigger than we thought it was, and then we wrap the ships up again. Last month we flew a few miles, discovered a range of hills—and only made page 16 in the *Times*. Discouraging, isn't it?"

"The trouble," remarked another member, scratching himself thoughtfully, "is that we have too much competition. What with bandits, and the MacRobertson Race, and the elections, and the NRA we can't make the first page any more. Besides, do you think anyone really cares what's down here, anyhow?"

"I guess most of us know there's a lot of ice," I replied, "and are content to let it go at that."

"What suckers we were to come!" began a member, when one of the others silenced him with, "Now, don't let's go all over *that* again!"

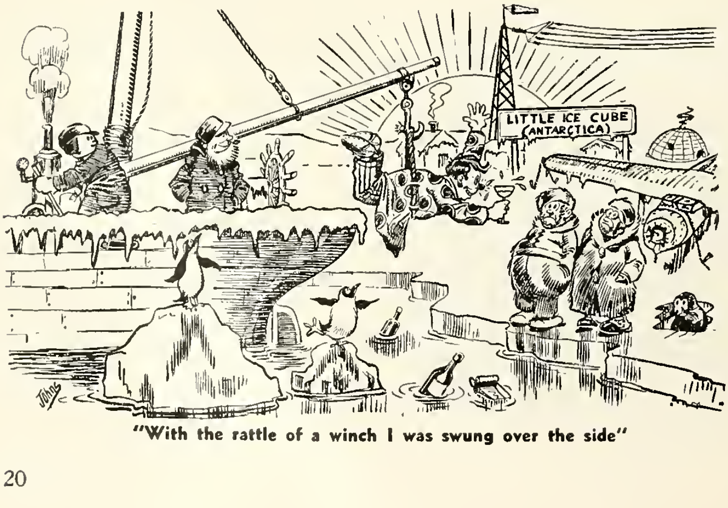
"I'd like to see the Admiral," I said, "But I fear I'm not dressed for Polar work." I indicated my dressing-gown.

"That's all right," they assured me. "We'll run you out in one of the heated limousines. Anyone using the Lincoln today? Or the Cadillac?"

While we chatted pleasantly in the balmy air, in which I found my light attire quite sufficient, a handsome limousine drove up, I got in, and with a cheery wave to the explorers was soon bowling along a smooth concrete boulevard. "I didn't know that you had such fine roads in Antarctica," I remarked to Zeke, the chauffeur.

"This is the fortieth expedition that's been down here," he told me, "so just to break the monotony the members built roads and went in for light farming—it's quite warm in the summer season, you know. We raise melons and bananas and cucumbers and boloney. You see that field over there—just over that ice hummock? Celery and olives. They'll be ripe before all the ice is melted, too. Very convenient."

Soon we drew up before a Colonial mansion with white pillars, silhouetted against a romantic back-ground of ice, snow, empty whiskey bottles. "The Advanced Weather Base," remarked Zeke. I was thrilled. To think that here, in these perilous surroundings, Rear Admiral Sir Hubert Richard Ellsworth Bilkins had endured all the rigors of the Antarctic. Bidding good-bye to my brave



"With the rattle of a winch I was swung over the side" driver I hurried to the door of the mansion, tripped over an empty beer case, and knocked. After a long wait a shuffling sound drew nearer and nearer, and finally an old colored man who vaguely resembled Stepin Fetchit opened the door and inquired, "Is yo-all de rescue pahty?"

"No, I'm not," I said. "Who are you?"

"Ah'm Uncle Tom, de Adm'ral's caretaker," he replied. "Wondah whah at dat ole rescue pahty done got, ennyhow. Adm'ral bin callin' dem on de phone."

At this moment I was aware of a voice from the interior of the house, the sound of a man irritably trying to get a telephone number. "Hello, hello! Confound it, Operator, come back on the line, will you? . . . This is Admiral Bilkins speaking. . . . No, I *don't* want to leave a call for the morning! I want to talk to my Base at Little Ice-Cube. The number is LIttle 5467 J. . . . Yes, *J*—it's a party line. . . . Very well, call me." There was the slam of a receiver banging up followed by, "The service is lousy down here."

"Sho is, Adm'ral, sho is," said the old caretaker soothingly as he ushered me into the room. "Dey's a gemmun to see yo'—leastways he mought be one—but he says he ain't fixin' to rescue us, nohow."

"It's very annoying," remarked the Admiral more calmly, "but I've been waiting a week for a rescue party. And it's imperative that I be rescued this week. There is nothing exciting going on in the world right now and I should make the first page, right hand two columns. Next week they may shoot a bandit or the King of Checko-Slowuppia, and then I'd be lucky to get even a half column in back. Besides, the ice is melting and next week there won't be enough to take a picture of."

"I must apologize for interrupting you in your shaving," I said, introducing myself, for I noticed that he was smoothly shaved on one side of his face while the other side sported a luxuriant beard.

"No, no," laughed the Admiral. "Just a little experiment I'm making. I let it grow only on one side. Do you think I look better, smooth-shaven like Byrd? Or beavered, like Wilkins?" He turned each side of his face toward me, one after the other. "The secret of successful exploring is to put up an effective appearance when you go home to lecture. Now, which side do you prefer?"

"I like them both," I said enthusiastically. "We have had smooth explorers and rough, or burlap-faced explorers. But we've never had both on the same man at the same time. Why not talk facing to the left for the first half and facing to the right after the intermission? At least, you'll be different."

"That's a great idea!" exclaimed the Admiral. "Tom! Where is that old rascal? Tom! Bring us two highballs. That's another reason I want to be rescued," he added. "We're nearly out of rye."

At this moment the phone rang. "Hello?" he said. "You've been long enough answering. What are you all doing at the Base? Playing croquet! Well, where is that relief party? . . . Oh, it is, is it! Well, who told them to stop and plant flower seeds? Tell them to get moving, and they needn't stop to pick bananas, either. . . ."

"Sorry, gemmun," said Uncle Tom, entering with two glasses, "but we's all out ob ice—I'se de-freezin' de Frigidaire dis mawnin'."

The Admiral still held the phone. . . . "And tell them to bring some ice," he added, and hung up. "You'll pardon me if I take off this outfit," he said, referring to the fur suit in which he had been clothed, "but it's too warm and I only put it on because I expected the boys here with the cameras. Phew! A relief to be comfortable again. Take off that dressing gown if you find it too warm here. Steam heat, you know."

"You'll pardon me if I take this off"

"Tell me, Admiral," I said, "what happened to you down here? I read in the papers that you nearly passed out from suffocation."

"Yes, that rascal Tom stoked up and got the place too hot one night. That was in the winter, when the snow was banked up right to the roof—we get lots of snow here in the winter. Well, it seems a Polar bear came along—we saw his tracks next morning—and sat down on the chimney to get warm. That shut off the ventilation and I nearly perished. That's the closest call I've had."

"Speakin' ob calls," remarked old Tom, "Dat man who's sellin' sumthin' done come back."

"Well, show him in, show him in," said the Admiral. "If he has any good Bourbon, now—"

A rather seedy individual with long whiskers, shorts, a shirt, and a sun-helmet came in. "Gentlemen," he said, "I am working my way through college. If I sell enough subscriptions to Boys' Life—"

"I know," said the Admiral. "You'll go to college and quit working forever. Well, I've got Boys' Life."

"And Good Housekeeping?" queried the man.

"Also the Ladies Home Journal," said the Admiral. "In fact, if there's one thing these expeditions never run out of it's magazines. Good-day, sir, and if you see a rescue party headed this way, hurry it along."

At this moment there was a cheerful honking of automobile horns, and a chap from the Base stuck his head in the door and shouted, "Shucks, Admiral, we didn't know you were in a hurry to be rescued or we'd have been here yesterday. We just been sitting around, down at the Base. All right, boys, bring in the cameras—the Rescue is on. Come on, Admiral, get into your suit and pull the fur tippet over your head."

"Make it fast, boys," said the Admiral. "These suits are stuffy."

"Don't I know it!" said the rescuer. "Now Admiral, you're seated on that sofa, exhausted, or something. You say, 'My God! Will help never come?' Can you memorize that?"

"My God! Will help never come?" repeated the Admiral. "Speaking of which, did you bring any ice?"

"We brought two trays of ice cubes," replied the rescuer. "We're about out down at the Base, too. Come on boys, hook up the sound. Ready on the camera? All right, everybody! Camera! Lights! Action!"

"Just a minute," said an insistent though quiet voice. A small, determined-looking man walked into the room. "Gentlemen, what are you going to do with your valuable fur suits during the summer months? There is only one way to keep furs where moths cannot get at them—in the refrigerated storage vaults of I. J. Fox, America's largest furrier." He walked over to the Admiral, slapped him gently on the back. A flock of moths flew out of the suit and flitted around in the lights, which gradually began to grow dim.

"Do not let moths destroy your valuable furs," he continued earnestly, though he seemed to grow dimmer and more far away every moment. "Store them in our vaults, and next winter you'll have more than just the buttons." His voice grew louder, his form had almost vanished. Suddenly I noticed that I was back in my living-room, at Monotonous, Long Island. Yet still the man's voice came strongly. "Remember the name—I. J. Fox. This is station N U T Z, New York."

Commercial Aeronautical Meteorology

W. H. CLOVER

Meteorologist, TWA, Inc.

● The accuracy with which weather conditions are forecast for pilots flying the transcontinental route of TWA, Inc., between Los Angeles and New York, was indicated in a recent report which showed that for one month the company's 12 meteorologists maintained an average accuracy of 98.3 per cent in their forecasting. A total of 1,640 forecasts, or more than 50 each day, were made and the consistency of the reports was further indicated by the slight variance between the individual meteorologists. The highest individual accuracy was 99.7, the lowest 96.4 per cent.

The accuracy record was made possible by the adoption of the Polar Front or Air Mass Analysis system of forecasting, a method which has been used by TWA for a year or more, and which is based upon the movement of specific air masses, each with its own peculiar characteristics and their reactions on other air masses.

Present day air transport operations are demanding more of the meteorologist than any other industry now in existence, and these demands will increase, becoming more exacting as flying equipment is improved and pilot personnel becomes more experienced.

The very life of aviation, particularly the transport by air of passengers, mail and express, is contingent on the development of faster planes, with greater cruising radius and greater service ceilings.

As the speed and cruising range of planes increases, weather forecasts necessarily will have to be issued for greater distances, for long periods, and be more nearly accurate.

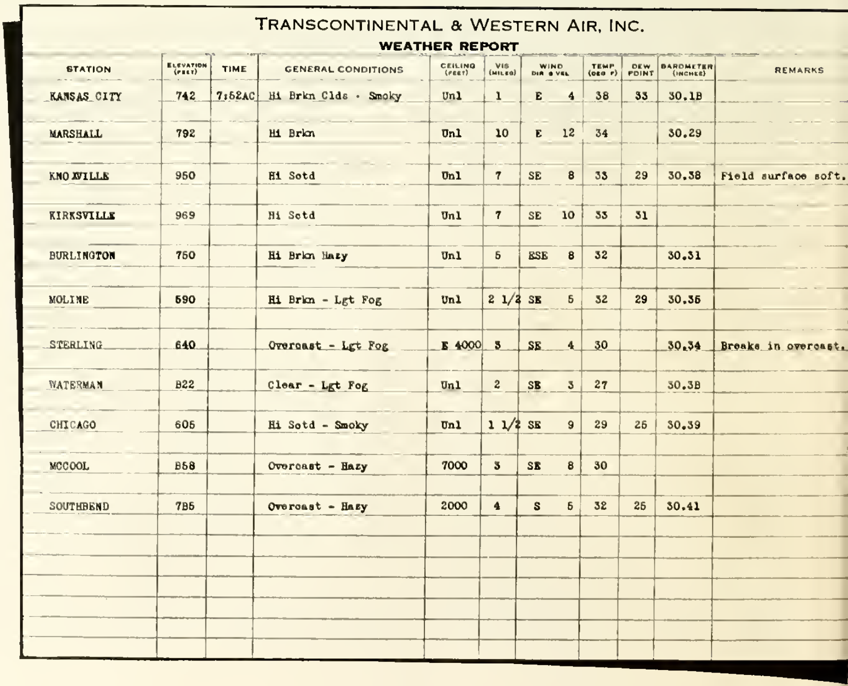
In June of 1929, Transcontinental Air Transport established a precedent in this country by employing a staff of meteorologists to forecast weather conditions over its airway. Considerable criticism of this move arose from various sources based on claims that the cost of such a private service was out of proportion to the benefits gained, and that, in effect it was duplicating the service offered and maintained by the Federal Weather Bureau.

Four years of experience has proven to TWA, Inc., successor to T.A.T., and Western Air Express, that the salaries paid its meteorologists are returned many fold in reduction of operating expenses.

No duplication of the Federal airways weather service exists. The commercially employed meteorologist is dependent upon the Government Bureau for all his statistical information and for the transmission of these reports. His function is to interpret and to adapt the Weather Bureau observations to the particular needs of his employers.

Considerable difference exists between the forecasts issued for general distribution (those published in daily papers) and those issued for airways operators. The transport operator and the pilot must be supplied with information giving the type, degree, time and duration of cloudiness, precipitation, visibility and upper air direction and velocity.

The meteorological department of TWA has developed and is using the following table of forecasting terminology and values:



TRANSCONTINENTAL & WESTERN AIR, INC.

WEATHER REPORT

STATION	ELEVATION (FEET)	TIME	GENERAL CONDITIONS	CEILING (FEET)	VIS (MILES)	WIND DIR & VEL	TEMP (DEG F)	DEW POINT	BAROMETER (INCHES)	REMARKS
KANSAS CITY	742	7:52AC	Hi Brkn Clds - Smoky	Unl	1	E 4	38	33	30.18	
MARSHALL	792		Hi Brkn	Unl	10	E 12	34		30.29	
KNOXVILLE	950		Hi Sotd	Unl	7	SE 8	33	29	30.38	Field surface soft.
KIRKSVILLE	969		Hi Sotd	Unl	7	SE 10	33	31		
BURLINGTON	750		Hi Brkn Hazy	Unl	5	ESE 8	32		30.31	
MOLINE	590		Hi Brkn - Lgt Fog	Unl	2 1/2	SE 5	32	29	30.35	
STERLING	640		Overcast - Lgt Fog	E 4000	3	SE 4	30		30.34	Breaks in overcast.
WATERMAN	822		Clear - Lgt Fog	Unl	2	SE 3	27		30.38	
CHICAGO	605		Hi Sotd - Smoky	Unl	1 1/2	SE 9	29	25	30.39	
MCCOOL	858		Overcast - Hazy	7000	3	SE 8	30			
SOUTHBEND	785		Overcast - Hazy	2000	4	S 5	32	25	30.41	

Cloudiness—Degree, height (ceiling) and stratification.

Precipitation—Type, degree, time and duration.

Cautionary condition—Thunderstorms, line squalls, fog, ice—giving degree, duration, time and movement. Visibility—Actual visibility in miles to be stated when under 5 miles, otherwise stated as fair, good or unlimited.

Winds Aloft—Direction to 8 points of the compass, and velocity according to U. S. Weather Bureau scale. The term "variable" may be used when velocities are under 10 m.p.h., and from no sustained direction. The term "shifting" may be used when velocities are over 10 m.p.h., and direction varies more than 40°.

This table of terminology and values has been adopted largely because of the requirements prescribed by the pilots. To forecast successfully according to these exacting standards the closest kind of cooperation must exist between the pilot and the meteorologist. Other important features include: (a) detailed knowledge of the terrain along the airway and the peculiarities which influence local meteorological conditions; (b) a practical knowledge of the equipment flown; (c) personal contact with pilots and an understanding of their individual temperaments; and (d) frequent flights over the airway in all weather conditions.

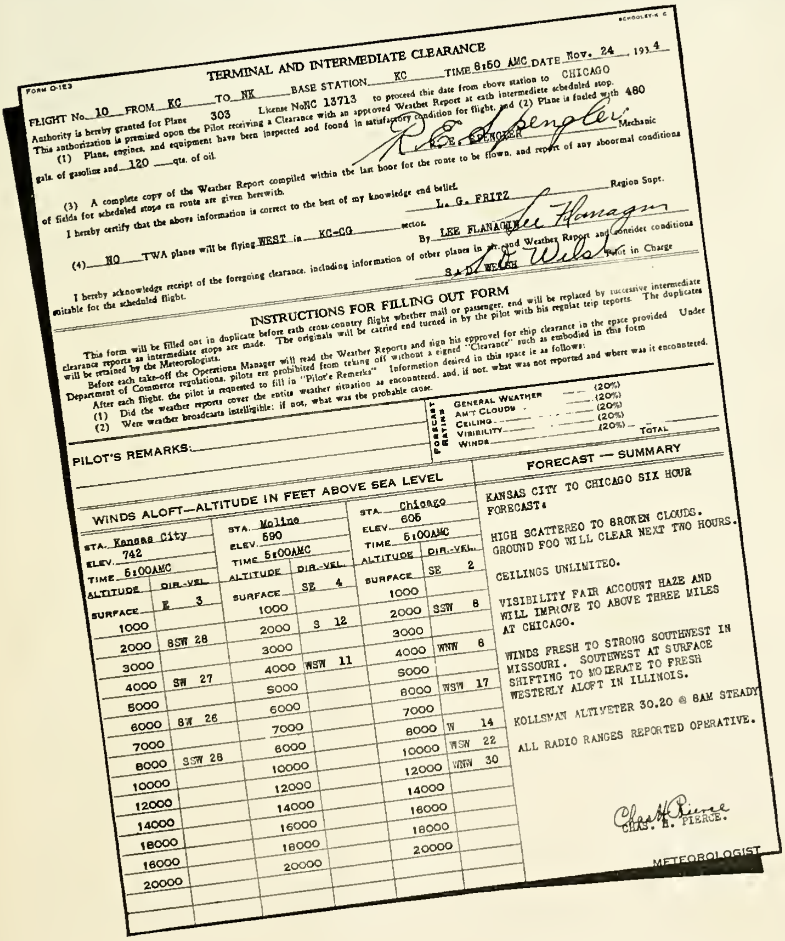
Verifying forecasts, and analyzing those which do not come up to standard, assists materially in increasing efficiency. In view of the fact that a large majority of the forecasts are called Trip Forecasts, that is, those issued for a specified flight from one scheduled stop to another and for a limited time (usually three to four hours), the bulk of the work of verification is placed upon the pilot to whom the forecast is issued.

On the weather report form given each pilot just prior to his departure is provided space in which, according to required practice, he grades the forecast according to the actual conditions encountered. At the completion of the flight the graded weather report is returned by the pilot to the meteorologists. If a failure is indicated, the pilot explains wherein the actual condition varied from those forecast.

Forecasts are based on information supplied by synoptic weather maps, and on the identification of the properties of air masses. Weather maps are constructed from weather observations taken at approximately 350 stations on the continent, and from selected ships at sea. The observations are all taken at 8:00 a.m. and p.m., Eastern Standard Time, and transmitted by telegraph or teletype to forecast centers. Isobar lines are drawn through all points of equal barometric pressure (reduced to sea level) denoting areas of high and of low pressure. Similarly, isotherm lines are drawn through points of equal temperatures, thus, relatively defining cold or warm areas. By observing a consecutive number of weather maps, the formation and progressive movement of cyclones (areas of low pressure) and anti-cyclones (areas of high pressure) and of warm and cold "fronts" can be noted. Air masses of different properties, that is, of different pressure, moisture content and temperature, when converging or when over or under running each other, produce definite physical results. The weather map serves to picture these conditions.

Knowledge of the properties of air masses is obtained by the use of meteorographs attached to airplanes, and in some instances, to kites. The meteorograph is a combined thermograph, hygrograph and barograph. Tracings from the pens of the three units are made on a sheet of smoked tinfoil, attached to a drum operated by a clock. Two hours are required, usually, to make an aerographic flight, and to compute the statistical data. The final step is transferring the data onto

(Continued on page 70)



SCHOOLEY-K C

FORM O-1E3

TERMINAL AND INTERMEDIATE CLEARANCE

FLIGHT No. 10 FROM KC TO NK BASE STATION KC TIME 8:50 AMC DATE Nov. 24, 1934

Authority is hereby granted for Plane 303 License No. NC 13713 to proceed this date from above station to CHICAGO

This authorization is premised upon the Pilot receiving a Clearance with an approved Weather Report at each intermediate scheduled stop.

(1) Plane, engines, and equipment have been inspected and found in satisfactory condition for flight, and (2) Plane is fueled with 480 gals. of gasoline and 120 qts. of oil.

R. E. Spengler
R. E. SPENGLER Mechanic

(3) A complete copy of the Weather Report compiled within the last hour for the route to be flown, and report of any abnormal conditions of fields for scheduled stops en route are given herewith.

L. G. FRITZ Region Supt.

I hereby certify that the above information is correct to the best of my knowledge and belief.

(4) NO TWA planes will be flying WEST in KC-CG sector.

By Lee Flanagan LEE FLANAGAN

I hereby acknowledge receipt of the foregoing clearance, including information of other planes in air, and Weather Report and consider conditions suitable for the scheduled flight.

S. D. Welsh
S. D. WELSH Pilot in Charge

INSTRUCTIONS FOR FILLING OUT FORM

This form will be filled out in duplicate before each cross-country flight whether mail or passenger, and will be replaced by successive intermediate clearance reports as intermediate stops are made. The originals will be carried and turned in by the pilot with his regular trip reports. The duplicates will be retained by the Meteorologists.

Before each take-off the Operations Manager will read the Weather Reports and sign his approval for ship clearance in the space provided. Under Department of Commerce regulations, pilots are prohibited from taking off without a signed "Clearance" such as embodied in this form.

After each flight, the pilot is requested to fill in "Pilot's Remarks." Information desired in this space is as follows:

(1) Did the weather reports cover the entire weather situation as encountered, and, if not, what was not reported and where was it encountered.

(2) Were weather broadcasts intelligible: if not, what was the probable cause.

FORECAST RATING

General Weather (20%)
Am't Clouds (20%)
Ceiling (20%)
Visibility (20%)
Winds (20%)
Total

PILOT'S REMARKS:

WINDS ALOFT—ALTITUDE IN FEET ABOVE SEA LEVEL

STA. Kansas City
ELEV. 742
TIME 5:00AMC

ALTITUDE	DIR.-VEL.
SURFACE	E 3
1000	
2000	8SW 28
3000	
4000	SW 27
5000	
6000	8W 26
7000	
8000	SSW 28
10000	
12000	
14000	
18000	
16000	
20000	

STA. Moline
ELEV. 590
TIME 5:00AMC

ALTITUDE	DIR.-VEL.
SURFACE	SE 4
1000	
2000	S 12
3000	
4000	WSW 11
5000	
6000	
7000	
6000	
10000	
12000	
14000	
16000	
18000	
20000	

STA. Chicago
ELEV. 605
TIME 5:00AMC

ALTITUDE	DIR.-VEL.
SURFACE	SE 2
1000	
2000	SSW 8
3000	
4000	WNW 8
5000	
8000	WSW 17
7000	
8000	W 14
10000	WSW 22
12000	WNW 30
14000	
16000	
18000	
20000	

FORECAST — SUMMARY

KANSAS CITY TO CHICAGO SIX HOUR FORECAST:

HIGH SCATTERED TO BROKEN CLOUDS. GROUND FOG WILL CLEAR NEXT TWO HOURS.

CEILINGS UNLIMITED.

VISIBILITY FAIR ACCOUNT HAZE AND WILL IMPROVE TO ABOVE THREE MILES AT CHICAGO.

WINDS FRESH TO STRONG SOUTHWEST IN MISSOURI. SOUTHWEST AT SURFACE SHIFTING TO MODERATE TO FRESH WESTERLY ALOFT IN ILLINOIS.

KOLLSMAN ALTIMETER 30.20 @ 8AM STEADY

ALL RADIO RANGES REPORTED OPERATIVE.

Chas. H. Pierce
CHAS. H. PIERCE.
METEOROLOGIST

The Paris Aircraft Show

● More international in character than for several years, the Fourteenth Salon de l'Aviation opened on November 16 in the Grand Palais, Paris where it continued until December 2.

Seven nations were represented and about seventy airplanes, including twenty-one military types, aircraft engines and accessories were on display. Indications were that the two years since the last Salon were devoted to consolidation rather than experimentation, and very little was shown that could be termed new or revolutionary. The trend seemed to be toward refinement and cleaner design through streamlining, with almost every machine being of practical and serviceable design. Few radical departures from conventional aircraft design were in evidence.

Among the interesting types shown were the Italian Macchi Castoldi 72 which established a world's speed record; the Russian ski-mounted P.S.5, which aided in the rescue of the crew of the ill-fated *Chelyuskin;* and the French Caudron C450 which won the Deutsch de la Meurthe Cup Race in 1934.

America was represented in the engine and accessories section by a Pratt & Whitney engine, Hamilton Standard controllable-pitch propeller, Bendix brakes, Irvin parachutes and Triplex. In the aircraft section, considerable interest centered about the Savoia Marchetti amphibion built up of stainless steel, shot-welded by the Budd process.

The commercial aircraft on display ranged from the inexpensive, small, open two-place jobs to the more luxurious four- and five-place cabin types; the larger commercial craft did not show as many types, but those on exhibition were interesting, particularly the mock-up of the new Breguet 46T which follows closely our transport designs.

Military planes were somewhat overshadowed by the commercial craft not only because they were fewer in number, but because there evidently was a suppression in allowing the most modern war craft to be shown. However, they created interest, particularly because they indicated the trend and various means of carrying armament. The French, for instance, leaning toward fairly clean-design cantilever monoplane bombers with retractable landing gears, are installing turrets in the forward section to allow the gunners and bombers both protection and added visibility, while flying in any attitude or at any speed.

There seems to be a definite tendency to deviate from all-metal construction for military planes, but there was every indication that metal was being used both for frames and coverings, particularly on the French craft. Where metal is used, duralumin appears to be favored among the French manufacturers, with the designers of other nations being more divided. Great Britain uses high-grade steels to a great extent, but the new Bristol commercial twin-engined plane has a fuselage of flat sheet metal alloy.

Two examples of stainless steel construction were shown in addition to the Savoia Marchetti. One is the complete wing skeleton of a Hawker *Nimrod* from England and the other is a commercial five-place cabin job exhibited by Russia. In the latter, shot-welding has also been used throughout.

Monoplane Designs Paramount

Monoplane design apparently has progressed abroad, since almost every country had one or more of these types on display. France, particularly, showed monoplanes in almost every model that was not a sesquiplane. Another noticeable departure was the substitution of metal propellers for the wood types and the use of controllable-pitch instead of the fixed-pitch propeller in most military airplanes.

A great number of machines shown were equipped with retractable landing gears. Two types seem to be used most; one in which the wheels swing back and up in a longitudinal plane, and the other in which the wheels swing out and laterally into a well in the wing. The latter type is found more often in single-engined types, while the former has been almost universally adapted for twin-engined aircraft.

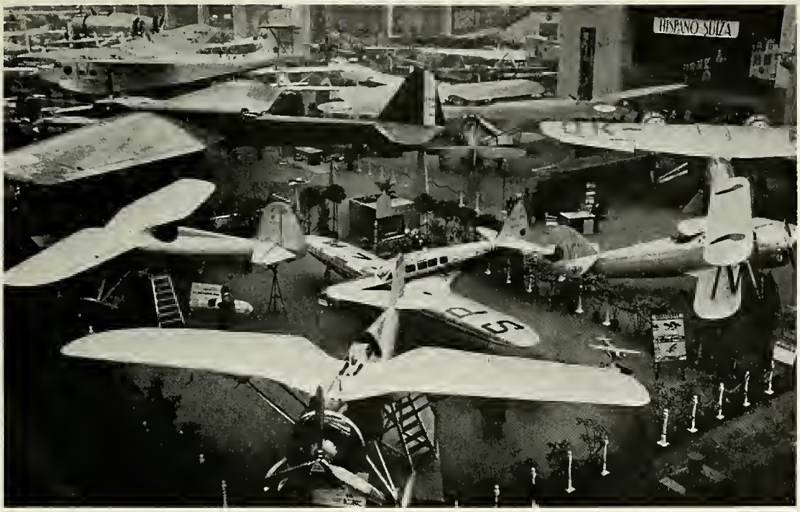
Engine development appears to be directed more toward full supercharging at higher altitudes and it was noticed that most engine companies were showing at least one supercharged model. Water-cooled as well as air-cooled engines were about equally shown and a number of French aircraft powered by water-cooled types were equipped with nose radiators which are carried on the front ends of the engine bearers, allowing its edges to project and sweeping the fuselage covering in behind so that there is a large gap through which the air can escape.

Transport Plane Trend

The lack of a large number of transport planes was evident but Lioré et Olivier displayed their four-engined monoplane flying boat for trans-Atlantic service (the largest at the show) and Junkers showed its Ju-52, a twin-float seaplane powered by three Diesel engines.

The Breguet 46T, or *Fulgur* as it is designated, shows, in mock-up, a decided resemblance to our Douglas or Boeing transports. It is a 12- to 14-passenger all-metal ship with two Gnome-Rhone *Mistral Major* engines which provide 1760 h.p., and help attain a top speed of 239 m.p.h. Wing flaps and a retractable landing gear are featured, the latter being of the individual type, each wheel swinging upward and back into wells behind and beneath the engine mountings.

Next in size was the tri-motored Avia 51 from Czechoslovakia which accommodates six passengers in a sound-proofed cabin built around an all-metal stressed skin fuselage. A Clark section has been



used for the metal frame, fabric covered cantilever wing.

Prominently displayed in the Farman section, was the F-430 a twin-engined low-wing transport for six persons. Construction is chiefly of plywood, with large windows running the entire length of the cabin providing considerably more light than is usual. The engines are Renault *Bengali Six,* of 190 h.p. each and the top speed of the plane about 152 m.p.h.

Interesting Light Craft

Among the interesting types of light and small planes, were the German Fieseler and Messerschmitt Me 108, both of which were constructed to comply to the requirements of the recent Challenge de Tourisme. The Fieseler with its 225 h.p., Argus AS 17 engine claims a top speed of 155 m.p.h., and a landing speed of 37 m.p.h., while the Messerschmitt, using a Hirth 250 h.p. engine, attains a top speed of 193 miles an hour and lands at 37 m.p.h.

Of the four small Caudron planes exhibited, the C520 *Le Simoun* was the most interesting. From its appearance it probably is a development of the Caudron C450, winner of the Deutsch de la Meurthe Cup Race last year having a low wing similar to the racing job. However, it is a cabin plane, seating four persons. Powered by a Renault *Bengali Six,* inverted engine, its top speed is 199 m.p.h. and its landing speed, with flaps, 47 m.p.h. A Ratier controllable-pitch propeller is standard equipment.

The Polish P.Z.L. 26, also developed for the Challenge de Tourisme, was exhibited as a low-wing, three-place job equipped with Zap-like flaps and slots along the outer portion of the leading edge of the wing. An interesting slot of small span and large chord forms the leading edge of each wing root for smoothing out the airflow at the stalling speed.

Two autogiros were exhibited, one by A. V. Roe and Co., the English manufacturer and another by Lioré of France. Both were direct control types, wingless and of the C. 30 designation.

Foreign Fighters

France, Great Britain, Czechoslovakia, Poland and Italy exhibited military planes; Germany and Russia did not. As usual the fighters created the greatest interest, some of the fastest aircraft in the world being on display.

Among them were the Hawker *Fury* from Great Britain, the Morane MS 275 French fighter, the Polish P.Z.L. P.24, the Letov S231 from Czechoslovakia and the Fiat CR 32 from Italy.

Great Britain's Hawker *Fury* was of the "intermediate type" with a Rolls-Royce *Kestrel* engine and a top speed of 250 m.p.h. This type is used by the R.A.F., as an interceptor and fleet fighter.

France's Morane MS 275 exhibited was a single-seater fighter with a 600 h.p., Gnome-Rhone K9 engine, geared and supercharged to provide 225 m.p.h., at 19,000 feet. In general, the plane is an all-metal, fabric-covered parasol monoplane with a wide-spread undercarriage having the shock struts lead up to outrigger points which serve as anchorages for the wing struts. Wings sweep back sharply and two machine guns fire through the propeller.

The Polish P.24 has a gull wing of the parasol type, built up of light alloy similar to the type used in the fuselage, and throughout the entire construction of the plane. Powered by a Gnome-Rhone K14, the plane was probably the fastest exhibited, claiming a top speed of 257 m.p.h. Its formidable armament consists of four guns; two machine guns are inside the Vee of the wings and two Oerlikon 20 mm. guns are carried inside enlarged fairings, one on each side, at the junction of the bracing struts and the wings outside of the propeller area.

Czechoslovakia's Letov S231 conventional biplane fighter also laid claim to an extremely high speed. With a Walter KFS 900 h.p. *Mistral Major,* its manufacturers report a top speed of 251 m.p.h. Four large-calibre machine guns are carried in the lower wings, in two pairs. The general construction is of welded steel tubes and each undercarriage wheel is carried on a single strut, braced to the fuselage by three wires. The wing bracing is by N-struts at the tips and streamlined wires on the front spar.

The Fiat CR 32 is powered by a 600 h.p., Fiat A30RA engine and attains a top speed of 242 m.p.h. It is a fabric-covered two-place fighter with rigidly braced wings and an electric generator built into the upper center section.

Multiplace Heavy Bombers

France was the only nation represented in the bombardment class. From every indication, the equal-span biplane has been discarded by that country's designers and monoplanes, or sesquiplanes have supplanted it.

The Amiot 142 M, multi-seater bomber and fighter is powered by two Hispano engines and is a general purpose craft adaptable for day and night bombing, long-range reconnaissance and artillery spotting. It is a cantilever monoplane of all-metal construction with a rotating gun turret in the nose. Its wing area is 1,076 sq ft., and its gross weight about 16,000 pounds.

The Marcel Bloch 211 BN4 is a low-wing, cantilever monoplane of all-metal construction with stressed skin applied in flat panels. There is a revolving gun turret in the nose, and gun positions behind the wing and on top of the fuselage. The two engines are Hispano-Suizas and the top speed is 217 m.p.h., with a range of 1240 miles. The ship is convertible into a seaplane by substituting floats for the retractable landing gear.

Breguet's 41 M4 is another general purpose sesquiplane powered by two Gnome-Rhone 14 Krsd engines. Its top speed is 186 m.p.h., it can climb to 13,000 feet in 9 minutes, and its range is 750 miles.

Potez's general purpose 54 is a high-wing, strut-braced monoplane with a retractable landing gear and a maximum speed of 200 m.p.h., at 13,000 feet.

Four manufacturers represented Great Britain at the Salon; two came from Czechoslovakia, six were from Germany, four from Italy, and two from Poland. France, with eighteen representatives, had the greatest number of aircraft manufacturers at the show.

AVIATION ENGINEERING

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Design Limitations of Aircraft Engines

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● When the R.A.C. formula for computing the horsepower of a gasoline engine was proposed, it was based on a maximum piston speed of 1000 ft./min. The reasoning which led to this conclusion as reported by Sir Dugald Clerk[1] was a trifle loose, but, as is well recognized by designers of large Diesel engines, piston speed constitutes a limitation, or rather a criterion by which the output of an engine should be judged. The questionable arguments presented, and the failure of the R.A.C. formula to give even an approximately correct result have undoubtedly contributed to the disappearance of the use of piston speed as a criterion in aircraft engine design. A powerful design tool has thereby been neglected.

The principles of similitude have been applied to internal combustion engines by Purday[2] and by Maleev[3]. Briefly stated, if geometrically similar engines of different sizes are run at the same piston speed, the following points of similarity are evident from simple arithmetic. Hereafter the term "similar engines" will be used to denote geometrically similar engines running at the same piston speed.

(1) The velocity of flow through the inlet valves is a constant.

(2) The stresses in all parts due to the inertia of the running parts are constant.

(3) All vibrating systems, i.e., crankshafts, valve springs, the intake system, etc., are operating under exactly the same conditions. Thus if the crankshaft of an engine of 6″ stroke had a critical speed of torsional vibration at 2500 r.p.m., a similar engine of 3″ stroke would have a critical speed at 5000 r.p.m.

From (1) and (3) we may predict:

(4) *the indicated mean effective pressure of similar engines will be the same.* Consequently, it follows that:

(5) the stresses due to gas loads will be the same, hence *all stresses (bending as well as direct) in similar engines are the same.* (This does not apply to stresses set up by differences in temperature.)

(6) The indicated power output of similar engines will be proportional to L^2 where L is any convenient dimension of the engine.

Thus we see that the R.A.C. formula for horsepower rating ($P = .4B^2N$, where P is the horsepower, B the cylinder bore and N, the number of cylinders) is perfectly logical except that all engines are not equally well designed and hence not similar and, of course, the constant should be expected to change as the science of design progresses.

An extension of the similarity principle in the light of later information and with particular reference to the air-cooled aircraft engine leads to the following conclusions.

Lubrication

It is well known that geometrically similar journal bearings working at the same value of ZN/p (where Z is the working viscosity of the lubricant, N the r.p.m. and p the unit pressure) are working under the same conditions and have the same friction coefficient, f. It follows from (5) that p is a constant for similar engines. In order to have similar journal bearing conditions ZN must be a constant. Since from our similarity principle NL is a constant Z/L must also be a constant. In other words, for similar conditions of journal bearing lubrication, the working viscosity of the oil must increase directly with a linear dimension of the engine. Under these conditions the heat generated in a given bearing will be proportional to $pfNL^3$. Since p is a constant, and f is a function of ZN/p which is also a constant, Q, the heat generated in the bearing per unit of time, will be proportional to NL^3 or, dividing by the constant, NL, is proportional to L^2. Since the sections and surfaces for the dissipation of heat will also be proportional to L^2 *for similar engines with oil viscosity proportional to L, the temperature of any bearing will be a constant regardless of engine size.*

Unfortunately, present knowledge does not allow a similar analysis of piston and ring lubrication. We do know, however, that piston friction is roughly proportional to oil viscosity and to piston speed. If we assume that, similar to the journal bearing, the oil film thickness will be proportional to the clearance, we can say that for similar engines with oil viscosity proportional to L, piston friction m.e.p. will be roughly equal. Observing the practice in regard to oil viscosity in engines of all sizes, we find variations which apparently bear little relation to engine size or piston speed. Large stationary engines running at low piston speeds often run with oil viscosities of about 9 centipoises at 210° F. while the relatively high speed aircraft engines use oils as viscous as 25 centipoises at 210° F. The difference in operating temperatures is insufficient to justify the practice. It may be remarked here that since the accelerations of parts of similar engines are inversely proportional to L, the tendency to throw oil from the crankpins is less in larger engines and the distance it must be thrown to reach the cylinder walls is greater. Thus it may be that in smaller engines the increase in the viscosity of the oil relative to the engine size is in order to prevent excessive oil consumption. It would seem that a more logical attack on the problem would be to find some method of reducing the amount of oil reaching the cylinder walls. This would make possible the use of lighter oils and consequently improved mechanical efficiency, reduced bearing temperatures, easier oil cooling, less carbonization, and easier starting. Certainly, there is plenty of evidence to show that satisfactory lubrication of the piston and bearings may be had with much lighter lubricants than are at present used for aircraft engines.

Propellers

Similar engines require geometrically similar propellers in airplanes of the same forward speed. The propellers will be operating at the same value of V/ND (where V is the forward speed, N the r.p.m. and D the diameter) and hence at the same efficiency.

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[1] Clerk, D., *The Gas and Petroleum Engine*, 1913, pp. 511-519.

[2] Purday, H. F. P., *Diesel Engine Design*, 1919.

[3] Maleev, V. L., *Internal Combustion Engines*, 1933.

It will be noted also that propeller tip speed is a constant for similar engines and propellers at the same forward speed. Since small engines may run at higher r.p.m. with the same tip speed and the same efficiency, it is not strictly correct to speak of the r.p.m. of a series of similar engines as limited by the propeller. *The propeller limitation does not become more serious with larger similar engines, but with engines of larger numbers of cylinders, higher piston speeds and higher mean effective pressures.*

The author realizes that the necessity for gearing is also a function of airplane speed and that airplane speed *may* bear some relation to engine size.

Cooling

In similar engines the rate of heat flow to the cylinder walls per unit area should be approximately constant, since the intake velocity, and hence the turbulence, will be substantially the same for all cylinder sizes. If the rate of heat flow per unit area is the same, the total heat flow per unit time, Q, is proportional to L^2. Since the power is also proportional to L^2 it follows that for similar engines *(7) the rate of heat flow to the cylinder walls is a constant proportion of the power output.* If the heat flow per unit area is the same, the temperature drop between two points on the piston or the exhaust valve will vary (to a first order approximation) directly with the linear dimension of the engine. Thus we confirm what is well recognized by engine designers that *the cooling problem is more difficult in larger engines,* especially in those parts which depend upon metallic conduction through relatively long paths. In order to retain similarity in heat flow, we must use materials of greater conductivity in larger engines, the conductivity being proportional to a linear dimension. Obviously, this is not possible. It indicates, however, the increased importance of heat conductivity in large engines. A much greater benefit can be derived from the use of aluminum as a piston material in a large engine than in a small one.

In the air-cooled aircraft engine, the power output is definitely limited by the cooling of the cylinder. In order to obtain the greatest rate of heat transfer, designers have used the maximum number of fins which manufacturing limitations would allow. The fins are usually made as long as is practical, remembering that the temperature drop from the base to the tip of the fins increases with length, hence reducing the effectiveness. These considerations have led to the use of fins of the same dimensions for all cylinder sizes. This results in a constant ratio of cooling fin area to combustion chamber area, and since the rate of heat transfer per unit of combustion chamber surface is constant for similar engines, the cylinder wall temperature should be roughly the same for engines of all sizes. However, where baffles are used to guide the cooling air over the cylinders, with large cylinders the air will travel further and hence pick up more heat. If the fin size and the distance from the fin tips to the baffle are kept the same regardless of cylinder size, the temperature difference of the air entering and leaving the engine will be greater in the large engines due to the longer distance of travel. This factor makes the cooling of larger engines more difficult.

The output of an engine is not limited by the *average* cylinder wall temperature but by the temperature of the hot places. These points are almost invariably places where heat is removed by conduction through long metallic paths.

For these reasons smaller air-cooled engines may be run safely at higher piston speeds, higher mean effective pressures, or with less "fuel cooling."

Combustion and Detonation

Due to the fact that the turbulence is nearly the same in similar engines, the time of combustion will be proportional to L, and since LN is constant, the combustion will occupy the same number of crank degrees; consequently the combustion time losses will be constant.

One of the most important failures of the principle of similarity is in the matter of detonation. As has been indicated by the author, detonation is a function of the temperature, before combustion, of the last part of the charge to burn, and time of combustion.[4] Since the time of combustion is proportional to L, detonation will occur at lower compression ratios in larger cylinders. This, of course, is well recognized.

We may note here that the principal failures of the principle of similarity, heat flow and detonation, favor the smaller cylinder sizes, therefore, where heat flow and detonation constitute a limitation of output, as they do in the air-cooled aircraft engine, we should expect to find that smaller engines would run at *higher* piston speeds.

Piston Speeds and Weights

Figure 1 is a plot of piston speed against displacement for several well designed nine-cylinder aircraft engines. While somewhat irregular, as might be expected, the curve shows the reverse of the expected tendency. This means that the larger engines are running under much more severe conditions. Perhaps this accounts for the prevalent belief that it is possible to "scale down" a design, but not possible to scale it up and obtain a satisfactory engine.

That somewhat more care has been exercised in the design of the larger engines is indicated by the curve in figure 2 which shows that the weight of nine-cylinder radial engines follows very closely the relation $W = 200 + .4$ (displacement). If the engines were geometrically similar we should expect that $W = K$ (displacement). Of course, there is some constant accessory weight, such as the ignition system, but this certainly does not amount to 200 lbs.

To summarize, we have seen from the application of the principle of similarity that:

(1) The possibility of using lighter lu-

(Continued on page 45)

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[4] Taylor, E. S., *The Importance of Ignition Lag in Knocking,"* N.A.C.A. Technical Note No. 452.

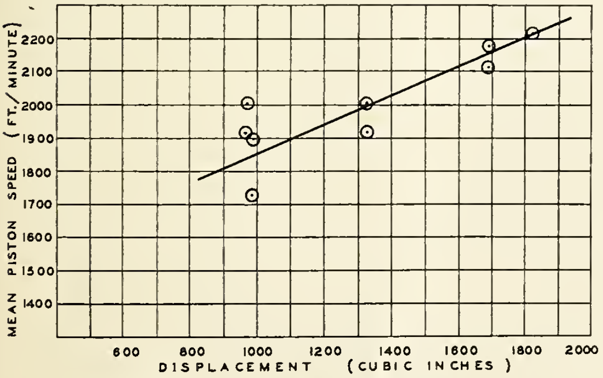


Fig. 1. Piston speeds of 9-cylinder radial engines

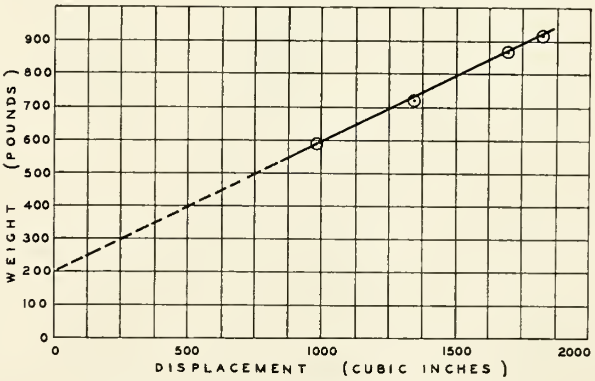


Fig. 2. Weight of 9-cylinder radial engines (1933)

Minimizing Radio Disturbances on Airplanes

●

JACK DELMONTE

Naval Aircraft Factory

● Radio receivers require extensive shielding from those extraneous influences that produce high frequencies of a disturbing nature. This is particularly essential to aircraft, where the electromagnetic disturbances to the radio equipment tend to reach alarming proportions. Lacking a solid ground, the aircraft radios are forced to utilize the structure of the airplane as a substitute. Experience has shown that good bonding of all metal parts and proper shielding of electrical conductors must be absolutely maintained if radio reception is to be satisfactory. While the methods employed to gain these ends are still being developed, recent information on the subject allows a more intelligent outlook of the problem.

Fundamentally, increased efficiency and improved quality of radio reception are obtained by maintaining good electrical connections between all contacting metal surfaces and by continuous screening of metallic surfaces (carrying electrical energy) against high frequency disturbances. Partial shielding is of little consequence as electro-magnetic disturbances diffuse through all available space; the shielding must be complete.

While the radio may be fully shielded, the antenna of necessity must be exposed, and hence, is subject to the disturbances emanating from the airplane. The major items contributing to the disturbances are: (a) magneto and ignition system; (b) poor electrical connections between metal parts; (c) electrical current-carrying parts, including vibrating contacts; and (d) aircraft generators.

It is generally possible to distinguish in the headphones between the noises caused by the ignition system and by the others, and in this fashion discover the most troublesome. The ignition system has proven to be the most disturbing element and consequently merits first consideration.

The magnetos generate a potential of several thousand volts for the spark gaps located in the cylinders of the aircraft engine, which voltage, while making and breaking at an extremely high rate, requires a first-grade shielding. Though the ignition cable itself is sufficiently insulated against any possible contact with the airplane structure or parts, sparks that are generated, set up a train of waves that produce damped oscillations of varied frequencies. While the frequencies of the electro-magnetic waves are dependent upon the particular circuit, the electrical constants give rise to broad and overlapping frequencies that are present in the broadcast range. This also applies to loose metal contacts on the airplane, where the potential between the metal surfaces may be sufficient to ionize the thin layer of air, resulting in radio frequency disturbances.

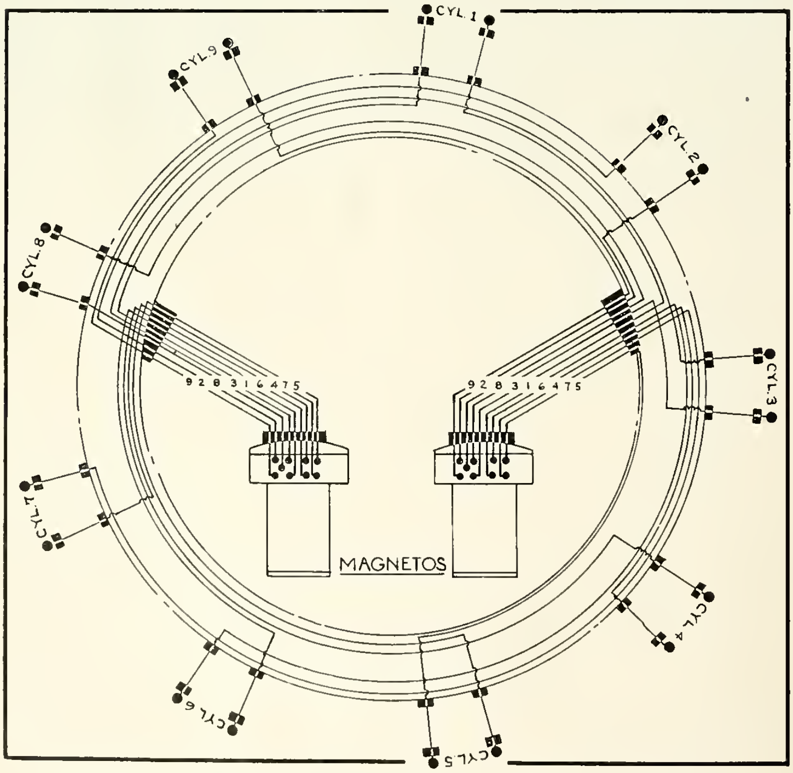


Fig. 1. Typical ignition system layout for a 9-cylinder aircraft engine

To successfully limit the disturbances of the ignition system a satisfactory conduit path must be maintained. As the paths of the ignition system are too irregular for solid conduit, flexible conduit is utilized to facilitate the ease of bending and installation. A flexible conduit is constructed of a strip of metal, helically wound, and joined together through a suitable interlocking of surfaces. To provide greater strength, the newest type flexible conduit has a full, four-face, interlocking of adjacent strips of metal. Over this conduit is placed the shielding braid, which is composed of a large number of small wires woven as groups or 'picks', generally two over and two under, into a suitable braid that allows high coverage with sufficient flexibility. While the proper weaving of the braid forms an interesting study, more recent information indicates that the security of this conduit and its braided wire shielding at the conduit fittings is of paramount importance, especially in the ignition system. The conduit, both flexible and solid, must be secure at the joints. The ignition cables, passing from well-shielded terminal housings on the magnetos through flexible conduit, enter a solid distribution ring. From this ring extend smaller flexible conduit carrying the ignition cable to the individual engine cylinders. A typical ignition system layout, shown in figure 1, illustrates the numerous conduit fittings, totalling 40, for a 9-cylinder radial engine. The specific fittings used for this case are a ferrule, coupling nut, and some threaded male member. Whereas, heretofore, the braiding wires were woven closer to provide better shielding, a more careful study of joints and the fittings of the conduit for improved shielding is recommended. It has been learned by experience that it is essential to tighten the conduit fittings after each flight if radio disturbances from the ignition system are to be kept at a minimum. This factor can not be under-emphasized, and must be given close attention.

In addition, it is good practice to ground the ignition conduit to the structure of the engine or plane every 18″ or less. While the ignition cable may be suitably shielded, these efforts are useless if the magneto housing does not provide adequate shielding. The recent designs of this equipment are tending to make the threaded parts for the conduit integral with the magneto housing. In any event, the fit must be tight for this, and all fittings, as a slight looseness of a threaded joint may mean the difference between good and poor reception. The throbbing and the vibration from the engine tends to loosen the fittings, and if careful maintenance is not observed, more secure fittings must be designed. In this connection, a few recourses are open, either through the new design of fitting with a self-locking scheme, the use of lock-wire after assembly, or else a stronger material such as stainless steel, that will not give readily after tightening. The entire conduit system is of aluminum alloy, for lightness and corrosion resistance purposes; tinned copper braid is sometimes used. Desirable materials are resistant to the corrosive action of a salt water atmosphere, in which airplanes frequently fly; seaplanes, in particular, require close attention to this detail.

Though the conduit fittings warrant major attention, there is need for good, flexible, closely-woven braid over the flexible conduit. Samples of poor braiding and good braiding are shown in figure 2. The closely woven braid forms a distinct contrast to the poorer one, illustrating a more satisfactory coverage for radio shielding. The amount of shielding to provide is a function of the frequency and the voltage of the disturbance; the higher the voltage or the frequency, the more complete should be the coverage. A time-honored formula provides the method of calculating the coverage of a shielding braid. It can be easily derived from a study of the number of wires, the pitch of the winding, the nature of the braid, and the size of the conduit. The formula is as follows:

$$P = \frac{A \quad B}{2\ C \cos \Phi}$$

where $P+P\ (1—P)$ = % coverage

A = total number of wires in the shielding braid

B = diameter of shielding wire (in inches)

C = pitch of one winding (in inches)

D = (outer diameter of the conduit — $2B$) . π

Φ = arc tan C/D

The formula assumes that the wires are laid flat and parallel. This is not strictly so, as the interweaving of the round wires leaves grooves that are not accounted for in the formula for the coverage. In the larger size conduit (2″ and 2½″), about 192 wires are used in the shielding braid, and it is quite difficult to maintain a uniform weave without misalignment of wires. Until recently, a majority of the shielding-braid specifications were based upon a required percentage of coverage as calculated in the above formula. Early Army Air Corps specifications, for example, called for a minimum of 70% coverage. This did not prove satisfactory and coverage values were raised, without a satisfactory knowledge of what per cent coverage constituted adequate shielding—a question that is still difficult to answer. However tight conduit fittings are essential if the shielding braid is to be at all effective.

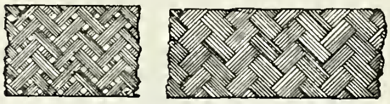


Fig. 2. Open and closed mesh cable braid

There is a distinct need for a standard measuring device for the effectiveness of shielding. Crude water leaking methods, as proposed in early Navy Department specifications, were far from acceptable. Direct, high frequency electrical measurements are needed, and it is noteworthy that steps are being taken in this direction. Likewise, to exemplify other electrical endeavors in this study at present, it would be well to point out recent attempts to correlate the electrical resistance across diametrically opposite contact points placed on the outside of the conduit, to the effectiveness of the shielding. Whether this will prove a satisfactory test or not remains to be seen.

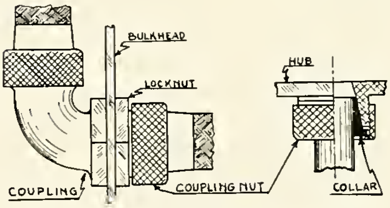


Fig. 3. Several types of conduit fittings

Applications of shielded, flexible conduit other than the ignition system are found at various points about the airplane where bending and vibration render solid conduit impractical. As an example, conduit to running lights in the tail surface are cited. Nevertheless, best conduit practice dictates little use of flexible conduit and employing the solid conduit wherever possible.

While the adaptation and the application of electrical conduit in airplanes is by no means standardized, there is reason to believe that such steps are not far off. Conduit for the Army and the Navy airplanes have been in vogue for a few years; not only has this practice given a long life assurance to the electrical distribution on airplanes, but it also provides adequate shielding of radio disturbances. The extent of electrical applications on airplanes demands that a dependable distribution system be maintained as protection for the numerous accessories, and in that capacity conduit is indispensable. To carry the various sizes of cable, ten sizes of conduit have been standardized, ranging from ⅜″ to 2½″ outside diameter. They are constructed of aluminum alloy for low weight.

A number of conduit fittings have been developed (and have been adopted as standard for naval aircraft) keeping in mind that it is frequently necessary to pass the conduit through bulkheads, and make connections to junction boxes.

The illustrations in figure 3 depict several types of conduit fittings, showing two typical assemblies. Until a short while ago it was standard practice to subject the conduit and their fittings to an anodic treatment for the formation of a protective film of aluminum oxide, as its corrosion resistance properties made it desirable. However, experience showed that this added precaution was unnecessary, besides the anodic film of about .0002″ thickness, causes a poor electrical connection at the joints. As a matter of fact, aluminum oxide makes a good insulating agent, and at times is used for that purpose. Likewise, there are added installation difficulties when it becomes necessary to ground or bond the conduit, as the aluminum oxide film must be scraped away to leave a pure metal surface exposed to the bonding or grounding agent. For the past year the airplanes of the Coast Guard, for example, have not had their electrical current-carrying accessories anodized, and no difficulties or excess corrosion are anticipated.

At present, extensive investigations are under way to determine a suitable antisieze compound for the threaded parts, a compound that will allow a smooth fit at the junction, and at the same time permit good electrical continuity. The present compound used on Navy airplanes is composed of 50% zinc dust and 50% petrolatum. A recent set of experiments upon the electrical resistance of lengths of conduit installed in airplanes gave results that were considerably different from the calculated values, to as much as 300% in excess. This discrepancy is undoubtedly due to the large values of joint resistance of the conduit fittings that were present.

Satisfactory maintenance of good electrical connections over contacting metal

(*Continued on page* 32)

Air Transport Operations at High Altitudes

●

ERIC W. WOOD

● High speed flying up to the present has been conducted at relatively low altitudes (sea level to 15,000 ft.), and although phenomenal advances have been made, with cruising speeds more than doubling in the last ten years, there is greater progress to be made in this direction.

Increase in speed has been the result of reduction in frontal area which has led to greater aerodynamic efficiency, and to the use of more powerful engines. The development of light metal alloys, controllable-pitch propellers, doped fuels and more efficient wing sections have played an important part also; but the reduction of drag through streamlining and the overcoming of drag through increased power, have been the two levers used in raising airplane speeds. Further advances in speed are continuing and operating cruising speeds of 300 m.p.h., are now in sight. However, with resistance increasing as the square of the velocity at sea level, there is a speed limit beyond which it is neither practical nor economical to fly without materially raising the cruising altitude of the airplane, in order to travel in a region where air density and resistance are reduced. Both in commercial and military flying, the question of raising cruising ceilings of aircraft is of paramount importance.

The earth's atmosphere extends to an altitude of approximately 28,000 ft., over the Polar regions, and 56,000 ft., over the Equator, its average height over the United States and Europe being 38,000 ft. Above the atmosphere is the stratosphere, and the point of transition from one to the other is known as the tropopause. In the atmosphere there is a steady decrease in temperature, in density and in pressure, with increase in altitude; in the stratosphere, although the density and pressure decrease with altitude, there is no vertical change in temperature, and over the United States and Europe it remains constant at about −67° F. Besides reduced resistance, another advantage to aircraft travel in the stratosphere is the lack of clouds, vertical air currents, rain, snow, or the formation of ice. Furthermore, although prevailing winds over the United States are westerly at 15,000 to 20,000 ft., winds of high velocity are to be found almost constantly from the East, from the Northwest and from the Southwest at various higher altitudes. So there exists aloft the combination of both favorable wind channels, and perfect weather conditions, on the trans-continental and on many other routes. It may be of interest to state that research work has been conducted by the Weather Bureau with pilot balloons at altitudes exceeding 115,000 feet (22 miles), and that no unusual changes in conditions exist even at these altitudes.

At sea level, air resistance produces so great a drag on even a perfectly streamlined airplane that, within present knowledge of aerodynamics and propeller-engine units, there is a definite speed limit beyond which it is unlikely that we shall travel at low altitudes. The practical limit for transports or other large aircraft flying below 20,000 ft., is probably 350 to 400 m.p.h., and before this limit is reached the problems of stratosphere flight must be solved. High-speed transports of the future will (of necessity) fly at levels where decreased density will reduce drag.

Among the problems presented by high altitude flying, the following are most important: (a) design of the airplane; (b) breathable air in the cabin; (c) a propeller-engine unit, efficient at high altitudes; and (d) instruments and radio.

With the mass of accurate information now available on wing sections, streamlining, control surfaces, flaps and other auxiliary airfoils, the aerodynamic design of the airplane presents little difficulty. It is generally agreed, at least in this country, that a monoplane of low frontal area with a high aspect ratio and a retractable undercarriage would give the best results. The choice of a wing section lies between a thin section for speed, and a high lift section for take-off and climb and since great advances have been made in the last few years in combining these two characteristics, there is no difficulty in modifying present designs of known efficiency to create a wing section that would be aerodynamically satisfactory. Wing areas with loadings in the neighborhood of 12 to 15 lbs./sq. ft., would be advisable, and this will necessitate a considerable increase in the wing area of the average modern transport, if the same gross load is to be carried.

Another (though minor) problem lies in the contraction of engine and other control cables, etc., while flying at high altitude, due to intense cold, but satisfactory results have been obtained by several methods, one being the use of springs in the controls to allow for contraction and expansion with changes in temperature.

The problem of satisfactory air conditions in the cabin is a question of maintaining air of an adequate oxygen content, and of sufficient density so as not to subject the pilot and passengers to lower pressures than their physical makeup allows. The first problem can be solved by supplying oxygen in either gas or liquid form, with the type of equipment now used by the Army and Navy and by some airlines (for example Pan American Airways on their route over the Andes). The second problem will require supercharged, airtight cabins capable of maintaining sea level, or near sea level pressure, at high altitudes.

Wiley Post, with the cooperation of the Goodyear Tire and Rubber Co., and the Army Air Corps, is attempting to solve the question of air pressure with the use of a supercharged rubber suit; and in the latest world's altitude record made in Italy, the pilot, Renato Donati, encased his body in tape before taking off. These methods, although satisfactory for a record attempt flight of short duration, could not be used under normal operating conditions. Supercharging a cabin requires comparatively little power, for although a 450 h.p., engine consumes about 45,000 cu. ft. of air (at sea level density), per hour, a passenger requires only 300 cu. ft. Cabins can be made airtight with double walls, and with windows of much stronger glass than is now used. This will add to the weight of the aircraft, another reason necessitating an increase of wing area of present designs, if the same payload is to be carried.

With the cabin air-conditioned for high altitude flying, it will be practical to ascend and descend at whatever rate the pilot selects for the conditions at hand, subject only to the limits imposed by the performance and structural factors of the airplane, without having to deviate from the most efficient rate of climbs and power glides for the comfort of the passengers. In present transport equipment, descent at more than 400 ft./min., results in discomfort to the average passenger, and in a flight conducted under conditions where, for example, 12,000 ft., is the most efficient cruising level, this necessitates commencing the glide while still 30 minutes away from the airport, without allowing the pilot to remain at the most efficient altitudes for favorable winds, smooth air, and lack of ice formation conditions. With air conditioned cabins this period will be greatly reduced.

Three- and four-bladed controllable-pitch propellers have been designed which give excellent performance at various cruising altitudes when set with a high pitch, and also give satisfactory take-off and climb at low altitude with a flat pitch. The latest development in this direction is the Hamilton Standard automatically controllable propeller which keeps the engine at constant speed, thus leading to greater operating efficiency. Some further loss in thrust power over brake horsepower will take place when flying at high altitudes, but this should not bring the thrust power below 75% of the delivered power, and with pitch now controllable over a wide range of degrees, the choice of propellers presents no serious difficulty.

The major problem lies in the present loss of engine power at altitude, and a curve tracing theoretically this power decrease for an average supercharged aircraft engine shows that this engine would deliver zero horsepower at approximately 75,000 ft: The power loss in a practical demonstration run several years ago in a variable density test chamber on a Curtiss D12-D supercharged engine, can be seen in the appended table, which shows that the engine actually lost all its power at 55,000 ft. (The 100% figure was arbitrarily taken for purposes of tests only.) However, since these tests were run, considerable progress has been made with multiple and with exhaust driven superchargers. In the latter, use is made of the increase in power of exhaust gases with altitude. In the former, the supercharger unit is composed of a group of several centrifugal superchargers, which can be put into gear in succession.

Variation of B.H.P. of a Supercharged Curtiss D12-D Engine

Standard Altitude (Ft.)	% of Sea Level B.H.P.
0	100
6400	90
15600	80
25000	70
28400	60
31400	50
36200	40
44800	30
46000	20
50800	10
55000	0

The high difference in pressure resulting from the action of the supercharger leads to a great increase in the temperature of the air after it is compressed, and this can be taken care of by using longitudinal tubular radiators along the fuselage which reduce the temperature of the air before it is admitted to the carburetor. At the same time, the low density of the outside air necessitates employing large oil (and water) radiators, despite the fact that the outside temperature over 45,000 ft., is constant at −67° F. Although there is no aircraft engine in production today which maintains its sea level power up to sufficient altitude to allow transports to fly in the substratosphere, so much design progress has been made recently that such power plants will be completed in the near future.

A comparison of the efficiency of various engines at altitude, brings up the question of weight-per-horsepower, a subject about which there is a great difference of opinion. When the weight-per-horsepower of two engines is compared, it is essential to know at what altitude these comparisons are made. For example, taking two engines in current production we find that at sea level:

Engine Model	Horsepower Delivered	Weight (pounds)	Weight (lbs./h.p.)
A	715	940	1.31
B	650	940	1.44

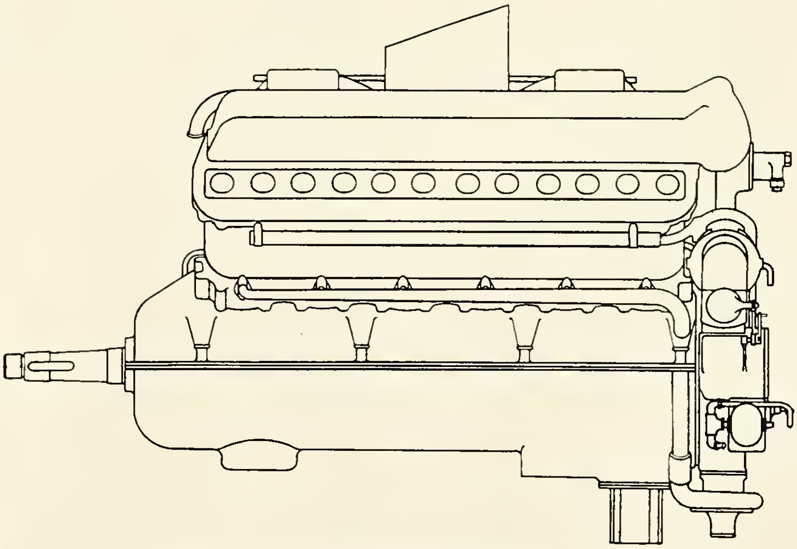
giving Model A a 9.1% more efficient *P/W* ratio at sea level. But, at 15,000 feet:

A	420	940	2.23
B	580	940	1.62

Therefore, at 15,000 ft., the comparative *P/W* ratios of the two engines are changed, and Model B has a 27.4% more efficient ratio. At higher altitudes, or with increased supercharging of the second engine, the comparative advantages would be still greater.

For this reason, among others, great progress can be expected in raising the cruising ceilings of airplanes with the development of Diesel engines, for the loss in power at altitude with this type of power plant is much less than in spark ignition engines.

American and foreign engineers have come to the conclusion that for flying above 30,000 ft., much may be accomplished in the future with the use of steam for power plants, instead of using internal combustion engines. This conclusion is correct, presupposing that steam power plants can be reduced to approximately 5 lbs./h.p. and comparing them to present internal combustion engines of 1.2 lbs./h.p. For as the power of the latter decreases with altitude, the *P/W* ratio approaches that of the steam engine whose power remains almost constant, and at high altitudes the steam power plant has a definitely lower *P/W* ratio. With the great advances made in supercharging,



Side view outlines of the water-cooled supercharged Curtiss D12-D engine

high compression, doped fuels, and Diesel engine design, it should not be necessary to go out of the field of internal combustion engines to produce a power plant capable of carrying a specially-designed transport to cruising ceilings of 50,000 ft., where the density of the air is reduced to 15% normal.

At present, about 30% of scheduled flights are flown with the use of blind flying equipment, but these instruments will be necessary on at least 70% of flights where schedules call for flying above 20,000 ft. Unquestionably the greatest progress towards maintaining air transport schedules has been in the development of this equipment. From the various methods combining the use of blind flying instruments and radio which showed merit for landing under conditions of zero visibility, a standard procedure has been evolved, and on the Federal Airways, equipment is now being installed which will soon allow flying throughout the United States without any outward visual reference. Thus, the industry has developed equipment which in the near future will allow aircraft to operate without regard to weather conditions.

Much higher cruising speeds than those on present schedules will be available aloft in the future. This country possesses the necessary engineering skill, research laboratories and manufacturing facilities. The questions of high altitude flying are on the verge of solution.

RADIO DISTURBANCES

(*Continued from page 29*)

surfaces is a function of bonding. A good electrical connection, as defined by Army-Navy Standards, does not exceed .0025 ohms electrical resistance. This value serves as a criterion for a large number of bonded joints. A portable milliohmmeter for measuring low electrical resistances serves as a fine piece of testing equipment for bonded joints. For the best results, the test should be made before the paint finish is applied, precluding the additional possibilities of contact resistance of the probe points of the milliohmmeter, which should contact the pure metal surfaces on either side of the joint. While heretofore, low values of current were passed through the joint under test, it is likely that higher values of current to the extent of a few amperes will be passed through the joint in future inspection, as the casual electrical connection through small metal particles can be eliminated by the passage of higher currents, which will burn out insignificant contacts, and give a truer value for joint resistance.

A number of permanent metal-to-metal joints upon the airplane do not require bonding. This includes joints made by welding, soldering, riveting, and brazing; other joints like clamped and pinned fittings, machine screws with lock-washers, threaded wire ends, also fall within this classification. Metal parts under heavy tension, as fuselage brace wires, cabane wires, etc.; members that are movable to unlimited extents as tail wheels, hand reels, etc.; small metal parts, permanently isolated and insulated; and sliding cockpit enclosures, sliding panels, and cowling, where the contacting surfaces are bare metal, need not be bonded. The criterion of .0025 ohm resistance should serve to determine whether a joint should be bonded or not. All metal parts that are unconnected to the airplane structure or do not experience good electrical connection should be bonded.

The methods of bonding are not difficult and consist generally of providing a good electrical connection over an otherwise poor conducting joint. Tinned copper braid, and various metallic strips and foils are suitable for conducting or metallizing. With these mediums the electrical continuity is maintained. The connecting strips are suitably held by clamps or terminals on either side of the joint. An added precaution must be observed in avoiding the contacts of dissimilar metals, which condition enhances corrosion due to the contact difference of potential of various metals. For example, the application of a brass or copper clamp to an aluminum joint may be avoided by the less active presence of cadmium-plated steel washers. The extent of the bonding application is a problem of the individual airplane.

Uncertain electrical contacts on the airplane are detrimental to radio reception. While the source of the disturbances may only be of minor importance, they are discernible in ultra-sensitive receivers. Induction and friction setting up static charges on one point or another and the casual meeting of metal surfaces as introducing capacitative effects, cause radio disturbances. The policy of a single conductor system, negative conductor grounded, a current Navy requirement, necessitates close attention to bonding and shielding, as the airplane structure acts as a return path for the electrical currents. It is a noticeable fact that the longer an airplane is in service, the noisier its radio reception becomes. The loosening of the conduit fittings and the weakening of the bonded joints by airplane vibrations, form satisfactory explanations for the decreased calibre of radio reception.

Vibrating contacts, prevalent among the airplane's electrical equipment, open and close circuits carrying electrical energy. The voltage regulator is a good example, as it is constantly vibrating, cutting in and removing resistance from the generator field circuit. This affects radio reception, when unprotected. However, as the contacts are usually confined to the relay units, the control box that harbors them should adequately shield them from the radio. Standard shielded terminal housings for attaching the conduit are provided with the control boxes. The fact must be kept in mind that any electrical equipment that resorts to vibrating contacts must be fully guarded against disturbing radio reception, through proper shielding practices.

In addition to the vibrating contacts in the control of the generator supply voltage, the generator itself is sometimes a disturbing influence to the radio, chiefly through the inevitable small, bluish sparks during commutation. This condition is exaggerated with the double voltage generators that have a high voltage commutator at 500 to 1000 volts. A switch placed in the field circuit and located in the pilot's cockpit, enables the breaking of the field circuit and prevents the generator from functioning in the event that faint radio signals that are being received, are affected by the presence of the generator.

While complete elimination of the radio disturbances is unlikely as long as there are in existence influences outside of the airplane, satisfactory radio reception is within reach by careful attention to the airplane structure as outlined above. It is important that all sources of disturbance are traced down and corrective measures are applied.

"THE NEW METAL PHANTOM WILL SOON BE AVAILABLE IN THE $3500 PRICE FIELD."

LUSCOMBE
Airplane Corporation

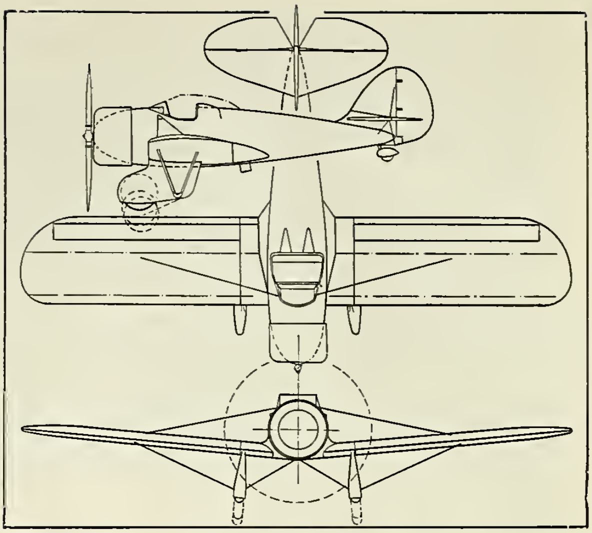
Cunningham-Hall Commercial Monoplane

●

RANDOLPH F. HALL

● Flight tests are being conducted on the new GA-21M, a two-place, low-wing monoplane manufactured by the Cunningham-Hall Aircraft Corp., Rochester, N. Y. Designed for commercial use, and particularly for the private owner, the GA-21M is equipped with the Cunningham-Hall high-lift wing and a unique lateral control system which was developed to improve the ship's general performance, safety and utility.

The high-lift wing allows high top and cruising speeds with low landing speed, steep angles of climb and glide, and short landing and take-off runs. Automatic in operation, the wing is said to save weight and add simplicity to the control system; it insures steadiness in flight, avoids dangerous flight attitudes and gives improved flight characteristics near the stall angle.



Outline drawings of the 145 horsepower Cunningham-Hall 2-place sport monoplane

Lateral surfaces are mounted in the upper rear surface of the wing above the underflap, permitting the use of a wing flap that is continuous throughout the entire span. The wings are braced above at each side by a pair of streamline wires forward of the cockpit; the flying wires are doubled and anchored at the rear of the undercarriage structure.

All-metal monocoque construction has been utilized in the fuselage which is smooth-skin covered. Wing structures are also all-metal, covered by a combination of fabric and metal, and control surfaces and wing flaps are metal-framed, fabric covered. Control surfaces and the control system are ball-bearing actuated and the rudder is of the balanced type. The adjustable stabilizer is set above the fuselage, placing it in an effective location and permitting good bracing from below.

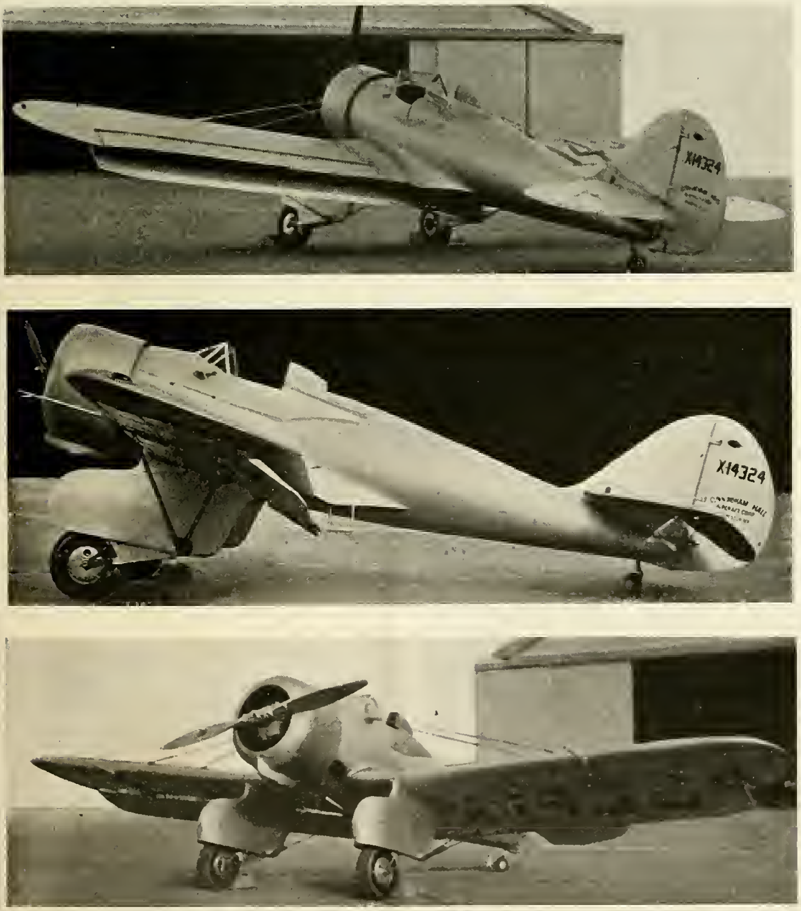
Streamlining has been carried out by a full NACA cowl, fillets at the junction of the fuselage and wing, and aft where a streamlined tail wheel is used. Streamlined chassis fairings house the semi-retractable wheels of the undercarriage which has a tread of 6 feet 6 inches. The wheels raise 16 inches into the fairings.

The open cockpit accommodates two persons in a side-by-side seating arrangement. A 10 cubic-foot-capacity baggage compartment is accessible through a door in the top of the fuselage and, from the cockpit, through a door in the seat back. When desired, this compartment is arranged to carry a third person.

Power is supplied by a 145 h.p., Warner Super Scarab engine equipped with an 8-foot diameter Hamilton Standard propeller.

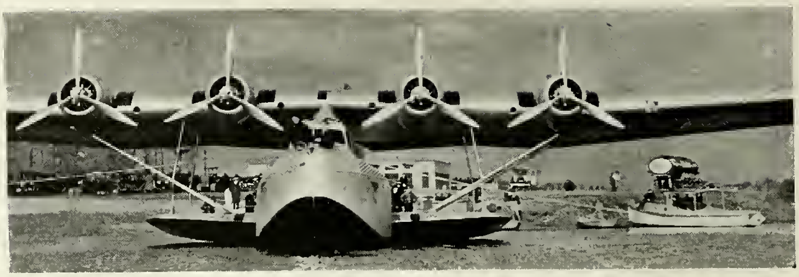
Specifications of the Cunningham-Hall GA-21M are as follows:

Wing span	30 feet
Overall length	20 feet
Overall height	7 feet
Wing area	130 square feet
Wing chord	56 inches
Weight empty	1300 pounds
Useful load	775 pounds
Gross weight	2075 pounds
Fuel capacity	32 gallons
Oil capacity	3.75 gallons



Views of the Cunningham-Hall plane with flaps and wheels lowered

Pan American's Martin Flying Clipper Ship



Front view of the P. & W.-powered Martin all-metal Flying Boat

● Pan American Airways' largest transport airplane, designed by the Glenn L. Martin Company for the Pan American Airways System specifically for trans-ocean air service, was brought out of the construction hangar at the Baltimore, Md., plant late last month to be put through its initial flight tests. The huge flying boat, which is capable of carrying 50 passengers on present international routes and whose range exceeds by a wide margin the longest over-ocean stretches in either the Pacific or the Atlantic, has been in the course of construction for the past two years, after being designed by the Martin organization from basic specifications developed by Pan American staff engineers and their Technical Committee. Final construction details on the ship are being advanced rapidly and it is expected that the plane will be available for the experimental service across the Pacific Ocean, which Pan American plans to inaugurate within the next few months.

The airliner is the first of three which the Martin company has under construction for Pan American Airways. It is much larger than any transport airplane yet designed for transport service.

The construction of the trans-ocean flying boat incorporates many advanced engineering details, but basically it is an all-metal, high-wing monoplane flying boat with 51,000 pounds gross weight, driven by four 14-cylinder Pratt & Whitney double-row Wasp geared and supercharged engines, developing 800 horsepower each, equipped with three-bladed Hamilton Standard automatic controllable-pitch propellers.

The ship is constructed of 24ST aluminum alloy, except for the engine mounts and the highly-stressed brackets and fittings, which are of heat-treated steel. The covering for all units is of high-strength aluminum alloy, except for the unstressed portions, which are fabric. Its total gross displacement is 263,640 pounds with a reserve buoyancy of 398% in the hull.

The 130-foot wing, which has an area of 2,170 square feet, tips slightly in the center section to give a modified gull effect and sponsons at the water line take the place of pontoons. Ailerons measure 32 feet 3 inches. The sponsons have a span of 33 feet 8 inches and an effective lifting area of 145 square feet; they also carry part of the 4,000-gallon fuel load. The balance of the fuel is carried in the hull and is pumped by oil-driven turbines to the reservoir tanks in the wings. These hull tanks form part of the underbody itself, thus eliminating considerable weight. Full-load wing loading is 22 lbs./ sq. ft., and power loading at full throttle is 14.91 lbs./h.p.

The new flying boat has a greater wing area and a lower wing loading than the *Brazilian Clipper*. While the Sikorsky has a comparatively long narrow wing of high aspect ratio, the Martin wing has a chord of 20.5 feet at the strut points, and an aspect ratio wing (S^2/A) of 7.78.

The hull both on top and on the aft underside, and the wing structures are built up of corrugated metal, those in the former running longitudinally to increase stiffness. Wing corrugations are covered with smooth metal, flush-riveted over the entire leading edge.

The wire braced tail surfaces are of the conventional type, utilizing divided elevators. The tail span is 40 feet, and the rudder is placed above the tapering streamlined extension of the hull. The stabilizer, which has an area of 203.6 feet fairs into the 11-foot 3-inch wide hull to carry out the streamlining effect presented by the ship.

Tabs are utilized on all control surfaces; those on the elevators measure 85″ × 4.75″; those on the rudder, 72.5″ × 6.25″; and those on the ailerons, 60″ × 6″.

The double-row Wasp engines are carried in nacelles set in the leading edge of the monoplane wing, two on each side of the hull. The two inboard engines are 8 feet 3 inches and the two outboard engines 12 feet 6 inches, respectively from the ship's center-line. Engine exhausts have been carried back above the wing, further reducing noise and with the soundproofing in the cabins, the sound level is expected to be about 72 decibels, comparable to a Pullman train running on a straight track. Provision is made for 200 gallons of oil.

At present the passenger compartments will be fitted with overstuffed settees convertible into berths for 18 persons for the trans-Pacific service. There will be a lounge or sitting room with bookcase, table and desk. The interior arrangement back of the pilot's compartment and flight deck, provides first for galleys and then two large compartments, one of which is the proposed lounge or club room which is convertible into dressing rooms. Further aft are more convertible compartments and toward the tail are quarters for a crew of three.

Flight operations take place from a half-deck above and in front of the passengers' accommodations. The pilot and

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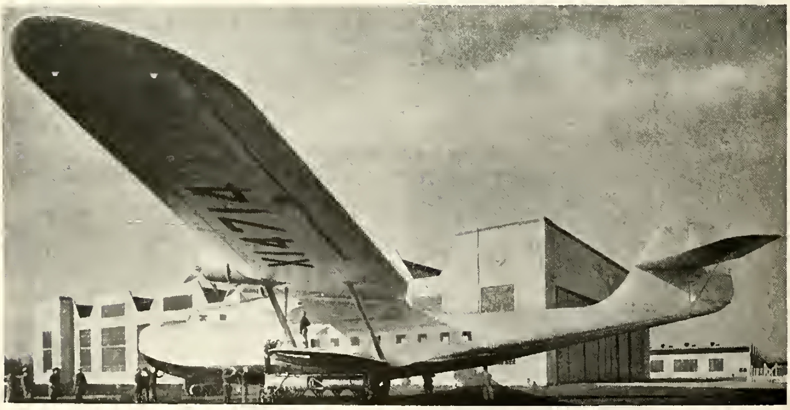


The Glenn L. Martin Clipper Ship ready for launching

Hamilton Standard Controllable Pitch Propellers Contribute to the Success of "Flying Clipper Ship No. 7"

TO THE "FLYING CLIPPER NO. 7" goes the honor of being the world's largest transport. And to Hamilton Standard Controllables goes the distinction of being selected for use on this 48-passenger flying boat. This all-metal, high-wing monoplane was designed and built by the Glenn L. Martin Company from specifications developed by staff engineers of Pan American Airways for service on the lines of this company. Four three-bladed Hamilton Standard Controllables contribute to the high performance of this new transport. When serving as combined passenger and mail plane, this ship will have a cruising range of some 3,000 miles—sufficient to take in its stride the longest over-water leg of any projected route across either the Atlantic or Pacific.

HAMILTON STANDARD PROPELLER COMPANY

EAST HARTFORD CONNECTICUT

SUBSIDIARY OF UNITED AIRCRAFT CORPORATION

Martin's Clipper Ship afloat during its initial demonstration tests

(Continued from preceding page) co-pilot sit side-by-side near the bow of the ship. Their operational and navigation equipment includes dual controls and a double set of flying instruments among which is a Sperry automatic pilot.

Above and to the right of the pilots are accommodations for the radio operator, his instruments and gauges. Across the compartment from him and on the same level is the navigator's table. Further back in the turret which forms the wing mounting is the mechanics station with separate special instrument boards.

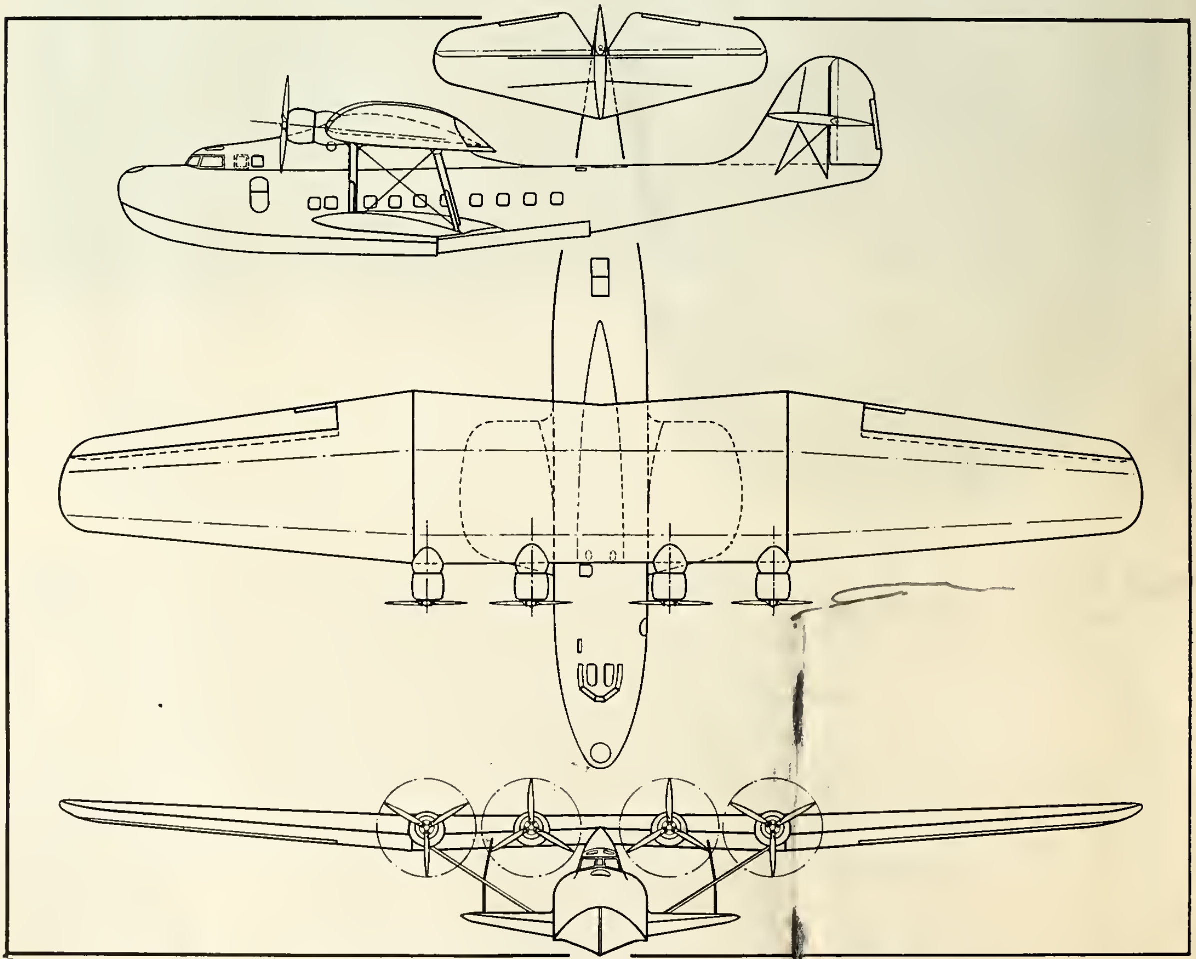
In flight tests at Middle River, W. K. Ebel, test pilot and assistant chief engineer of the Martin company, took off in a brisk wind and choppy sea in about twelve seconds. While no actual performance details will be made available until completion of all test flights, it is expected that the boat will show a top speed of 180 m.p.h., a service ceiling of 20,000 feet, a cruising speed at altitude of 163 m.p.h., and a landing speed of 70 m.p.h. No flaps or other retarding devices are incorporated in the original design. It is designed to fly on three of the four engines to 6,000 feet with full load. Flying at 145 miles an hour, at not more than 4,223 feet and utilizing 75% of the total available power, a duration of 20.49 hours is anticipated. The ship with full load is capable of a maximum cruising range as a mail plane of 4,000 miles and as a combined passenger-mail transport of 3,000 miles.

Specifications of the Pan American Airways Martin flying boat are as follows:

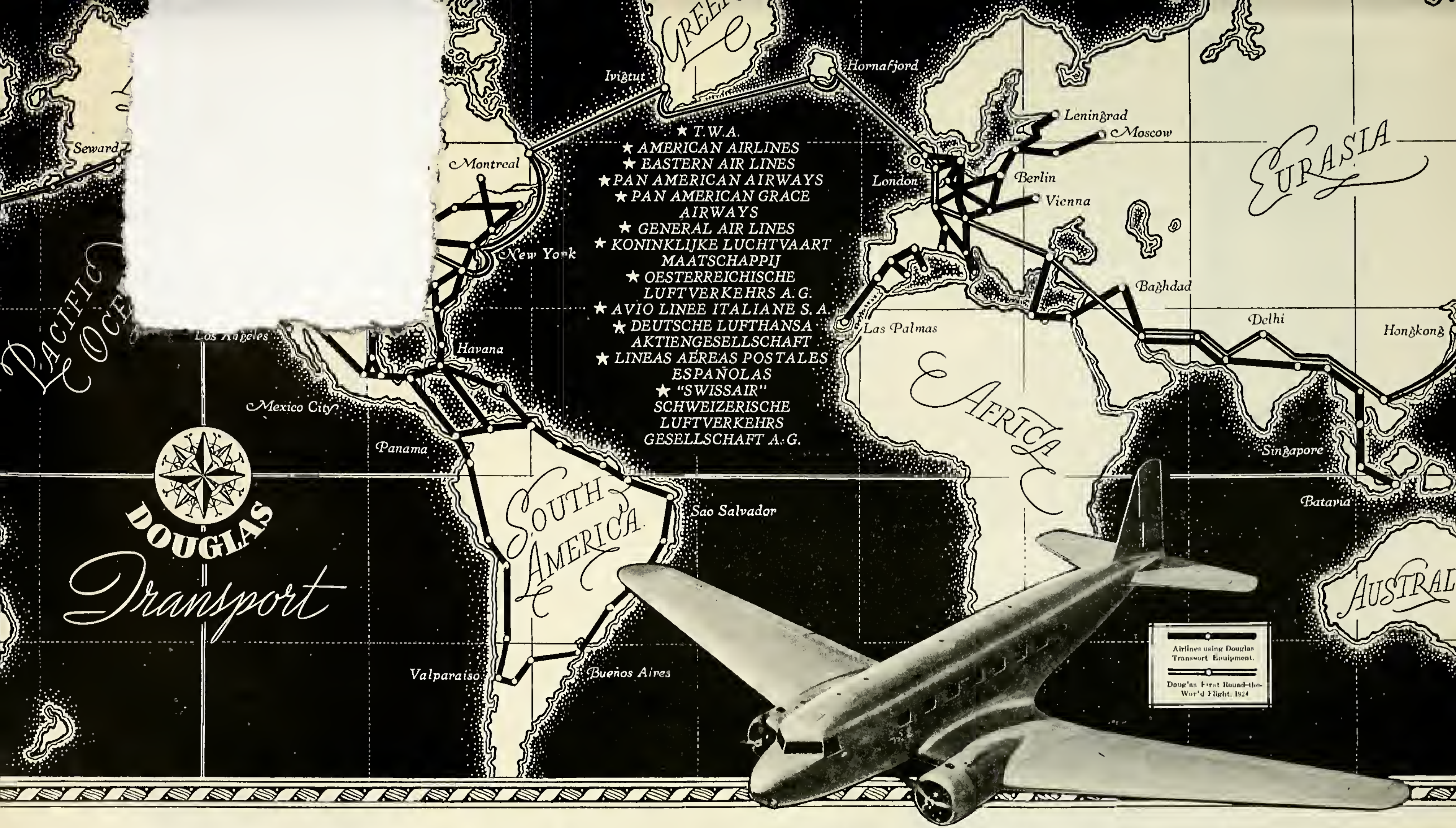
Wing span	130 feet
Length overall	89 feet 8 inches
Height overall	24 feet
Wing chord (maximum)	20.5 feet
Weight empty	23,100
Useful load	27,900
Gross weight	51,000

Areas (Square Feet)

Wing, including ailerons	2170
Total lifting area	2315
Stabilizer	203.6
Elevator	152.2
Fin	94.1
Rudder	65.6
Total horizontal tail area	355.8
Total vertical tail area	159.7



Scale drawings of the Glenn L. Martin Clipper Ship built for Pan American Airways



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The Laird Sesquiplane Model LC-EW 450

●

RAYMOND E. DOWD

● Since the spectacular appearance of the Laird "Solution" Thompson Trophy winner of 1930 and its sister ship, the famous "Super-Solution" of 1931, flown by Major Jimmy Doolittle in the record-breaking coast-to-coast flight of 11¼ hours, E. M. (Matty) Laird, one of our earliest "Early Birds" (whose ships are known since the days of Katherine Stinson) has been concentrating on the development of a single-engined, high-speed transport. This development was climaxed in the past few weeks when the new Laird 6-place transport the "Sesquiwing," was wheeled out of its hangar in Chicago for a test hop. The sleek blue and yellow sesquiplane was immediately the center of interest in Chicago's aviation circles.

The plane is a single-engine, high-performance, rigidly-braced sesquiplane, known as Model LC-EW450, the designation "LC-E" standing for Laird Commercial Series "E", and the "W450" indicating the Wasp engine horsepower.

Modern airplane design trend has been toward metal semi-monocoque construction and in the new Laird we find a metal fuselage and control surfaces adapted to a fabric-covered wood spar wing cellule. The excellence of the metal work dispels any idea that fabric-covered wings have been used because of difficulties attending the fabrication of metal surfaces. Factors influencing the designer's choice of this composite construction have been light weight, as well as low cost of manufacture, maintenance and repair.

Aluminum alloy materials have been used in constructing the all-metal semi-monocoque fuselage. The smooth skin (outer covering) is 24 ST alloy riveted to elliptical shaped bulkheads which are formed from 17 ST bulb "L" sections except the main bulkheads at the wing root stations which are of two extruded bulb "T" sections with a 17 ST web riveted between them forming an "I" cross section. The skin is in segments, extending from bulkhead to bulkhead and requires no special forming. Longitudinal stiffeners are added to support the skin between the bulkheads.

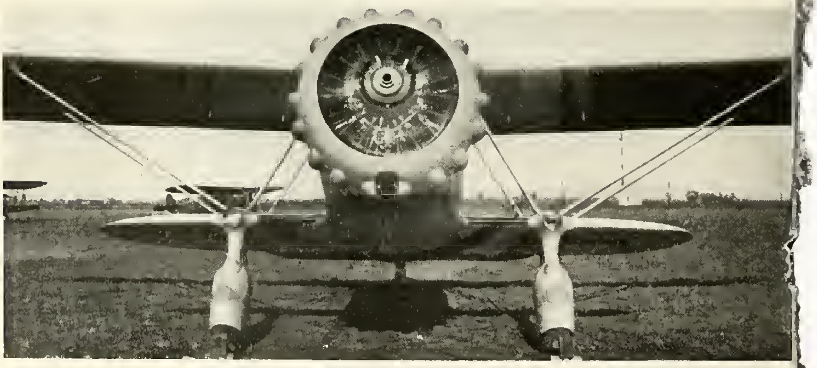
Upper wing panels and the outer tips of the lower stub panels are constructed with spruce "I" beam spars and reinforced plywood trussed ribs, fabric covered. Ailerons are hinged to the upper panels only and are smooth skin 24 ST aluminum alloy. The inner section of the lower wing structure between the fuselage and the lift struts is of chrome molybdenum steel tubing. A socket, 6″ in diameter, is welded to this structure at the junction of the front spar and the first drag strut member to accommodate the landing gear oleo strut, the upper end of which telescopes into the socket. The trailing edge of the lower panels aft of the rear spar and extending across under the fuselage form the wing flap, which is also made of 24 ST alloy, as is the covering on the inner stub panels. Gas tanks are housed in both the upper and lower wings. Interplane struting is rigid and free of wires, with streamline tubular steel struts handling all flying and landing loads. Lower wing stubs are integral with the fuselage out to the wheel positions.

Tail surfaces are constructed of 24 ST aluminum alloy and are of the smooth skin full cantilever type. Elevator and rudder hinges are fitted with Fafnir ball bearings with longitudinal trim tab surfaces provided on the former. Specially hammered aluminum fairings streamline the fixed tail surfaces as well as the wings at their points of attachment to the fuselage.

The 106″ tread landing gear, equipped with 6″-travel Cleveland pneumatic struts, combined with 27″ Bendix wheels and General streamline tires, is non-retractable. The top ends of the struts are pressed into the socket in the lower wing structure while the wheel forks are attached at the lower (or piston) end. The landing gear is, however, housed in faired wheel pants and lies out of the propeller slipstream. The tail is supported on a full swiveling tail wheel fitted with an oleo pneumatic strut of 6″ travel.

The power plant is the Pratt and Whitney Wasp C rated at 450 h.p., at 6,000 ft., and enclosed in a full NACA cowling bumped out at the cylinder rocker box locations to reduce cowl diameter. By this method it is possible to use a cowl four inches smaller in diameter than the engine. A 10:1 blower is used and the propeller is a two-bladed Hamilton Standard controllable-pitch type. The oil radiator located inside the cowl under the engine, is cooled by a tunnel in the base of the cowl. Engine mounting is of steel tubing suspended in four Lord shock absorbers at points of attachment to the main fuselage structure.

The two pilots' seats, located high in



Front view and outline drawings of the Laird sesquiplane with 450 h.p.

the nose of the fuselage, permit excellent visibility. Dual wheel controls mounted on a Y-type column and dual rudder and brake pedals are standard equipment as is a hand lever-type parking brake. Wing flaps are operated by a small hand crank located at the base of the main control column, while another crank, located over the pilot's head adjusts the tab surfaces at the trailing edge of the elevators for longitudinal trim.

The instrument board is fully equipped and the navigational instruments are separately mounted in a rubber suspension system. A radio receiving set is furnished, the short aerial being placed between streamline masts under the fuselage.

The cabin is spacious and attractively finished throughout with a spacious baggage compartment aft. Entrance to the cabin is on the right hand side to the rear of the wing structure, and an emergency exit is on the left side of the cabin at the center window. Pilots' windows are raised and lowered in automotive fashion, and those for the passengers are fixed, ventilation being provided through the roof. The rear of the fuselage is accessible for inspection through a door aft of the lavatory compartment. Cabin appointments include a heater, upholstered chairs, Rusco safety belts and convenient assist straps. For night flying, two 3-minute Wiley flares are installed as standard equipment.

Specification and calculated performance figures of the Laird LC-EW450 are as follows:

Overall length	27 feet 6 inches
Overall height	8 feet 8 inches
Upper wing span	38 feet
Lower wing span	17 feet 6 inches
Wheel tread	8 feet 10 inches
Wing loading	21.3 lbs. per square foot
Power loading	11.9 lbs. per horsepower
Total wing area	250 square feet
Ailerons	24 square feet
Fin	9 square feet
Rudder	7.2 square feet
Elevators	18 square feet
Stabilizer	22.7 square feet
Fuel capacity	150 gallons
Oil capacity	10 gallons
Gross weight	5,350 pounds
Empty weight	3,205 pounds
Payload	1,170 pounds
Useful load	2,145 pounds
Top speed	200 miles per hour
Cruising speed	175 miles per hour
Landing speed (flaps)	58 miles per hour
Cruising radius	850 miles
Service ceiling	21,000 feet

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Aircraft Fuels

The Magnetic-Optical Properties of Liquids. Application to the Analysis of Hydro-Carbons (Sur les propriétés magnéto-optiques des liquides. Application a l'analyse des carbures d'hydrogène), M. Schérer and A. Cotton. Publications Scientifiques et Techniques du Ministère de L'Air, No. 50, 1934, 91 *pp.*, 24 *figs.*

ROTARY PROPERTIES and the magnetic bi-refractive power of a wide series of hydrocarbons were studied for this report. The magnetic rotary molecular power of the normal series varies in the first approximation with the number of atoms of the carbon. The authors calculate the dispersions of the rotations and show that they are very near to normal paraffinic and cyclohexanic carbons. A formula giving the constant of Verdet is proved for the different wave lengths for a large number of carbons. The benzenic and naphthalenic carbons having strong bi-refractive powers, the authors studied radically different substitutes. They discuss the interpretation of the values of optical and magnetic molecular anistropes and propose a possible explanation for the action of the non-saturated connections. They apply the determination of optical-magnetic constants of carbons to the analysis of natural mixtures and explain how various gasolines and oils of diverse origin may be differentiated.

Aerodynamics

Pressure Exploration over an Aerofoil that Completely Spans a Wind Tunnel, W. L. Cowley. (British) Aeronautical Research Committee—Reports and Memoranda No. 1597, *October,* 1933 *(published October* 29, 1934), 13 *pp.*, 3 *figs.*, 10 *tables.*

THE TESTS reported were made in connection with the design of a four-engined airplane and with the purpose of showing that the flow over the airfoil approximated closely to two-dimensional flow as for infinite aspect ratio. Pressures were measured with the ends of the airfoil six inches from the walls of the wind tunnel and then again with the gaps filled in with pieces of the same airfoil section. It was found that the decrease in lift near the tunnel walls was not proportional to the lift, the largest percentage decrease occurring at the lowest angle of incidence tested.

French Wind Tunnel

The Institute of Mechanics of Fluids at the University of Lille (L'institute de mécanique des fluides de l'Université de Lille), W. L. Koporindé. Revue Générale de L'Aéronautique, No. 18, 1934, *pp.* 47-54, 9 *figs.*

HYDRO AND aerodynamic laboratories at the University of Lille are described. The Eiffel-type wind tunnel is 27 meters long, 14 meters wide and 12 meters high, and constructed in such a fashion as to allow operation with either free or guided veins. The author describes the form of blades in the test-chamber ventillator, which is extremely original and one of the curiosities of the new tunnel. Another original characteristic pointed out is the arrangement of an automatic control to maintain the current of air at a constant speed which at maximum power is 60 meters per second. Details of the hydrodynamic canal and the station for hydraulic tests are included.

The October issue of *L'Aéronautique* (Vol. 16, No. 185, pp. 236-240, 13 figs.) also contains a description of the apparatus at this institute by A. Martinot-Lagarde.

Lubricating Oils

Research on the Dispersion of the Components of Castor Oil (Recherches sur l'étalement des composants de l'huile de ricin), C. Bouhet and P. Lamarche. Publications Scientifiques et Techniques du Ministère de L'Air, No. 51, 1934, 39 *pp.*, 30 *figs.*

DISPERSION ON the surface of water of castor oil and of certain bodies intervening in its constituents was investigated for this report and a study of the dispersion of benzoate of benzyle, as well as of mixtures of ricin-oleic acid in variable proportions, is included. In regard to saturated films of ricin, the authors conclude that for each spontaneous evolution of the film, there corresponds a determined surface pressure. The study of benzoate of benzyle showed particularly well the instantaneous increase of the surface pressure. For ricin-oleic acid, the curves representing variations of surface pressure in function of the air occupied by the molecule in the film did not present an angular point, which is attributed to the formation at the curve of the acid of a notable quantity of lactides and lactones by the interaction of the acid functions and alcohol, secondary to the ricin-oleic acid. In the case of ricin-oleic acid mixtures, the angular point in the surface pressure curves disappeared when the mixtures reached certain proportions. The authors consider this of great importance and believe that a study such as this would indicate the existence of complex bodies of lactide or lactone type in greasy substances, while, by a study of mixtures with an acid grease, one can verify the presence of the secondary alcoholic functions.

(*Continued on page* 45)

. NEW EQUIPMENT and METHODS .

Zinc Chromate Primer

• A NEW zinc chromate primer has been developed by Berry Brothers, Detroit, Mich., to meet U. S. Navy specifications for protecting metal parts of aircraft. In addition to its corrosion inhibiting properties, the new zinc chromate primer is said to be quicker drying, and to adhere more firmly to metal surfaces, including dural, aluminum, steel and cadmium. The vehicle in which the finely ground, pure zinc chromate is suspended consists essentially of synthetic resins selected because they are more durable than the materials in conventional oil base or pyroxylin base primers, being less affected by light, dampness, temperature changes and the other destructive influences encountered in severe service.

Toluol is the recommended thinner to reduce the consistency for spraying, or for brushing on small surfaces, one to two parts thinner being used to one part primer. Special thinner is supplied when parts are to be dipped. Drying is so rapid that finish coats may be sprayed over the zinc chromate primer in emergency within a few minutes, much more quickly, it is said, than with conventional oil base primers. For best results in production a drying time of several hours is recommended in order that the coating may harden completely, or parts may be baked at temperatures up to 350° F. Properly applied the coat is so smooth that no sanding is required. As an under coat this primer is good for either lacquer or synthetic enamel finish coats.

Safety Balancer And Lifting Unit

• RECENTLY DEVELOPED by engineers of the Chicago Pneumatic Tool Co., New York, N. Y., a simple and sturdy counterpoise for suspending, balancing and lifting portable objects weighing up to 200 lbs., is being marketed under the name CP Super Safety Balancer. Seven types, in capacities of 30, 40, 75, 110, 130, 150 and 200 lbs., are available.

Long balanced travel is obtained by the combination of a tapered drum, single cable and a new method of applying the spring force, while two ball bearings at each end of the shaft provide support for the spring mounted between them. The springs can be adjusted for different loads by a hardened worm.

Eliminating clamp stops, a mechanically-operated geneva gear, independent of cable, regulates up and down stopping points. Hooks are of the closed-throat type, the top one being arranged for lateral adjustment to assure proper centering of cable and object.

In the event of spring breakage, the safety latch swings freely and immediately engages the teeth of the drum, thus preventing the load from slipping. The single-cable construction not only allows inspection at all times, but also facilitates removal of the cable without disassembling or altering spring adjustments. A cable-guide, faced with a removable and reversible soft steel block, keeps the cable (which has a safety factor of 10:1) in line and prevents jumping.

Dial-Operated Transmitter

• THE WESTERN Electric 14-A Radio Transmitter is a multi-frequency crystal controlled transmitter for telephone, CW or tone telegraph transmission, which may be preadjusted to any ten frequencies within the range of 2 to 18.1 megacycles. Any one of these frequencies can be selected by single digit operation of a telephone dial within the time required for the dial to return to its normal position. By redialing a single digit number, any other of the ten predetermined frequencies is made available.

The dial controls a standard telephone selector switch which closes the proper latching relay on one of ten vertical rods. This rod is then raised by a solenoid relay, closing the circuits to the tuning unit in each amplifier stage which has been pre-adjusted to operate on the desired frequency. The dial can be located at any convenient place thus providing a simple and effective remote control.

Ten quartz plates, one for each frequency, maintain the carrier within .025% of the assigned frequency. The transmitter delivers from 300 to 400 watts depending upon the operating frequency, with a total input power of approximately 3500 watts and can be operated on CW, MCW or phone with perfect modulation.

The system consists of two units. The rectifier unit contains a 200 volt grid bias rectifier, 800 volt and 2500 volt plate rectifiers employing mercury vapor tubes, an audio amplifier and the control relays. The transmitter unit contains the radio frequency generating and amplifying apparatus together with the dialing and switching mechanism. The entire equipment is self-contained and employs no rotating machinery, except a small fan which is used for circulating air about the transmitter power amplifier tube.

The equipment was designed by Bell Telephone Laboratories for Western Electric Company for use at aviation ground radio stations and coastal and ocean going vessels, where it is necessary to operate on a number of different frequencies with a minimum of lost time in changing from one frequency to another.

Dumore Hand Grinder

• A HAND grinder designed for production grinding of large and small dies, moulds for cleaning up weld spots and similar work where power is required has been produced by the Dumore Co., Racine, Wis. The motor develops 1/5 h.p., weighs 7 lbs., and features an air filter which keeps out grinding dust and dirt.

The filter of the No. 9 grinder, which is enclosed in the end cap and is easily removed, has a vacuum-cleaner-type ventilating fan which prevents heating.

The tool is equipped with three ball bearings, operates at 14,250 r.p.m., and can be supplied with either a spade-type handle or with a handle mounted on the side. It comes complete with wheel arbor, chuck for mounted wheels, small extension spindle and two grinding wheels.

The company is also marketing a new 1/7 h.p., 7½ lb., motor with forced air ventilating system, built-in speed reducer and equipped with a single-gear reduction unit capable of carrying the full motor power. It is of the universal type, operating on either DC or AC. Gear ratios of 5:1, 14.5:1 and 34:1 giving shaft speeds of 1300, 448 and 191 r.p.m., respectively, can be supplied. The grease-type gear housing forms an integral part of the motor frame.

The gear unit is fitted with a single ball thrust bearing to take the thrust of the worm. A reverse direction of rotation can be obtained by fitting the motor with a ball thrust bearing at the end opposite the gear unit.

Permanent Separators For Aircraft Batteries

• EXIDE AIRCRAFT batteries are now being equipped with separators of Exide Mipor, a new material which is a form of vulcanized rubber in sheets, permeated with microscopic passages to permit free diffusion of the electrolyte. These passages are so small that the most minute solid particles of active material are prevented from passing through.

Electrolyte solution does not affect the separators and because they are heat-vulcanized during manufacture, they are immune to battery-developed heat. They withstand vibration and the rough conditions of service to which batteries are subjected.

Exide Mipor lasts indefinitely, functioning as a permanent plate insulator, yet permits complete diffusion of the electrolyte at all times.

The Electric Storage Battery Co., Philadelphia, Pa., manufactures the Exide battery.

Indirect Arc Electric Furnace

• AN ELECTRIC melting furnace, designated type GM by Detroit Electric Furnace Co., the manufacturer, has been developed and engineered to increase the angle of rock of the furnace shell automatically. Featuring an automatic rocking device, the new furnace allows rocking angle increases—one rate being available for ferrous and another for non-ferrous materials. A special transformer, control panel and an oval instead of square-shaped charging door are standard equipment.

A feature of the rocking mechanism is that despite the constant-speed motor, the shell velocity is zero at the point of reversal, allowing a quiet, smooth running machine. Positive timing of the shell is attained by a gear to the reversing mechanism, and long-life for these units assured by water-cooled electrode clamps.

A special high-temperature refractory is used and with interchangeable shells, the furnace is applicable as a production or pilot unit for brass, iron or alloy steels in quantities of 25-50 lbs.

Metal may be poured with a temperature control of 3000° F., and the uniformity and control of metal temperature and melting atmosphere reduce volatization and oxidation losses to a minimum. Rated 35 lbs., cold charge or 30 lbs., molten, the unit can be used for experimental and test runs. The indirect arc, rocking action and atmospheric control make it effective where temperature and compositional control are factors.

The unit accomplishes such work as metallurgical development, special alloy production in limited quantities and making special castings where it is desirable to pour directly into moulds to eliminate temperature losses and oxidation.

Lear Radio Receiver

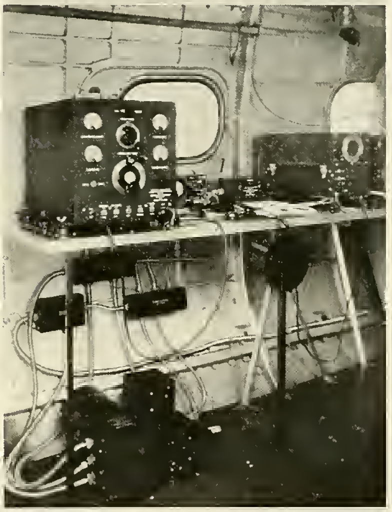
• THE LEAR Model "K" Aircraft Receiver manufactured by Lear Developments, Inc., New York, N. Y., is a 5-tube superheterodyne, receiver capable of tuning through three distinct frequency bands. A self-contained dynamotor power supply and a remote control unit are featured in this set, one of which was built for Roscoe Turner and the Boeing 247-D, which placed second in the speed section of the MacRobertson Race.

It is intended for use in any aircraft for the reception of beacon and airway signals in the frequency band from 195-415 kc, for the reception of standard stations in the band between 550-1500 kc, and for the reception of aircraft communication signals from 3000-6000 kc.

A particular feature of design in this 19-pound receiver is the incorporation in the receiver chassis of the dynamotor unit and filter system. It has been the practice in the past to make a separate unit of the dynamotor power supply which in turn necessitated inter-connecting cables and junctions.

By virtue of an improved filter design it has been possible to place the high voltage dynamotor in the receiver chassis itself without any resulting interference in the set. This has simplified the receiver and improved its performance.

The remote control unit (standard equipment) is of the circular, airplane type dial which permits the receiver chassis being mounted in any convenient location on the plane. The remote control head can be readily mounted in some accessible spot on the instrument board. From the remote control head the set can be turned on and off, the volume adjusted, either one of the three bands selected and the receiver tuned through each band as it is selected. The dial is calibrated in kilocycles and it is indirectly illuminated.


Lear Receiver in Turner's Boeing 247-D

The receiver operates directly from the standard 12-volt storage battery available on all aircraft.

Installation requires mounting of the receiver chassis and the remote control unit, the attachment of two wires to the storage battery and the connection of antenna and ground. As usual, it is also necessary to shield and bond the electrical and ignition system.

Noise within the receiver has been minimized and the sensitivity and selectivity of this receiver results in splendid reception on all three bands.

A single chassis measuring 6⅞" × 8⅞" × 11¾" carries both the radio receiver and the dynamotor with filter unit. While these two units are combined on a single chassis, the dynamotor with filter section is readily removed for service.

Measuring Instruments For Engine Parts

• TWO PRECISION instruments which should find favor in aircraft engine factories and in repair shops at the airports are now being marketed by Wilkening Manufacturing Co., Philadelphia, Pa., under an exclusive sales agreement with the Circle Gauge Co., the Los Angeles, Calif., manufacturers. They are the Ring "Mike" and the Pin "Mike," both used for measuring.

The Ring "Mike," made in three sizes ranging from 1½" to 9½" rings, measures all ring sizes on the same center line, drawing each ring against an angle which automatically maintains the same center line for all rings. Neither moving parts nor the measuring tape are involved in adjusting the instrument while the tape, made of Sweedish steel, is fastened securely at each end to prevent stretching.

The Pin "Mike" is for measuring the diameter of wrist pins, bushings, bolts and other pins to micrometer accuracy. The pressure exerted against the pin by the measuring rod is controlled by a uniform spring tension, thus giving more accurate measurement than tools whose pressure is controlled by the hands. The tool is made of aluminum and steel and in three models ranging from 0" to ½"; 0" to 1"; and ½" to 1½" pin diameters.

The pointers on both instruments are checked and set at the factory, and accuracy can be maintained with a master size ring or pin supplied with the respective instruments. On the Ring "Mike," adjustment is made by moving the pointer so it points exactly to the size on the dial corresponding to the size of the master ring. Adjustment of the other instrument is by means of a double-screw clamp around the shaft of the disc from which all measurements are made. Operation of both instruments is quick and easy, and readings are made through a magnifying glass on a dial calibrated in decimals and fractions.

To prevent damage, the dial and working parts of both instruments are enclosed in a solid housing.

36-Hour Floor Repairs

• RUTTED, ROUGH or broken concrete, wood, brick, asphalt or composition floors may be repaired or completely resurfaced and made ready for truck traffic in 36 hours by the Resurfacer made by the Stonhard Co., Philadelphia, Pa.

It provides a waterproof, dustless, non-skid and tough resilient surface which can be applied with an ordinary trowel. Extensive preparation is eliminated, and permanent repairs to all types of floors and platforms are easily made.

Pratt & Whitney E Hornet 750 H.P. Engine

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WRIGHT A. PARKINS

Experimental Engineer, The Pratt & Whitney Aircraft Co.

● The Department of Commerce has just granted Approved Type Certificate No. 136 to the S1E-G, first of the new E Hornet series manufactured by the Pratt & Whitney Aircraft Co., E. Hartford, Conn. It is a single-row, nine-cylinder fixed radial powerplant rated 750 horsepower at 7,000 feet.

The E Hornet, like the H Wasp, which was described in the October, 1934 issue of Aero Digest, is equipped with automatic valve gear lubrication, which improves starting, reduces valve-gear wear, simplifies servicing and cuts maintenance costs both in the shop and in the field. Engine oil under pressure is fed to a distributing groove machined in the nose section of the engine and thence through metering ports to the valve tappet mechanism. From the valve tappet it flows through the push rod into the rocker arm where it is distributed to the various parts in the rocker box requiring lubrication.

After serving its purpose, the oil is gravity-drained through the push rod cover tubes to the crankcase or through a newly-designed scavenging ring to a sump from where it is pumped back into the oil tank. By this means, oil is not permitted to collect in the rocker boxes either in flight or after the engine ceases operating. Consequently, the action of the valve gear is at all times normal, and starting, particularly in cold weather, is easier.

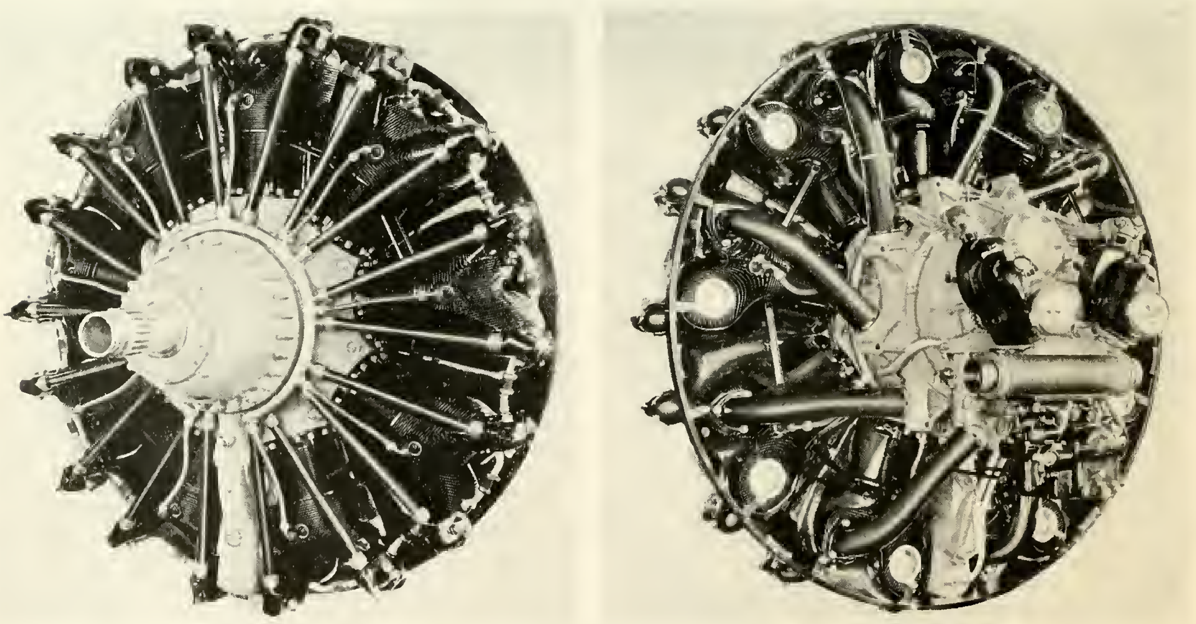
Included as standard equipment in the E Hornet is a thermostatic oil temperature regulator to be incorporated in the oil system of the airplane. This device not only relieves the pilot of manually controlling the oil temperature by automatically regulating the temperature of the oil entering the engine to about 68° C, but it also reduces the warming up period to about one half its former time. When starting, or when the oil is cold, the valve automatically directs the oil from the scavenging pumps to the bottom of the tank in close proximity to the suction line. Consequently, the warm oil coming from the engine is drawn into the suction line feeding the engine and is used over again. This process continues until the oil entering the engine approaches the desired temperature at which time the automatic valve begins to direct part of the oil through the oil cooler to the top of the tank and the suction line begins to draw from the main oil supply in the tank as well as from the hot oil supply coming from the engine.

Priming equipment has been made an integral part of the engine, and it is built into the carburetor. Priming is accomplished by manipulating the throttle and mixture control levers in the cockpit, making it unnecessary for the airplane manufacturer to provide priming fuel lines and pumps.

An improved centrifugal supercharger with strengthened impeller drive parts is provided in the E Hornet. The drive is so constructed that the intermediate gears are supported on either side by precision type ball bearings, increasing the reliability of the gears and reducing the loads on the bearings.

New diffuser passages increase supercharger efficiency and provide more uniform distribution which results in improved engine performance, longer valve life and reduced fuel consumption.

Improved design and choice of materials are evident in the cylinders and parts forming the combustion chambers. The cylinder is more rugged throughout, and comparatively deep and closely spaced fins (in combination with close fitting baffles) provide satisfactory cooling with leaner mixtures. The barrel, made from an improved alloy steel, is ground with a converging taper at the top so as to allow for expansion and provide a straight sided



Front and rear views of the latest Pratt & Whitney E Hornet engine which develops 750 h.p. at 7,000 feet

bore under normal running temperature. The demand for reduced fuel consumption has in part been met by improved valve design and valve seat materials. Austenitic steel valve seat inserts instead of bronze are shrunk into the cylinder heads. Exhaust valves are faced with stellite and (as in other P. & W. models) are sodium cooled. The sodium chambers, instead of being cylindrical, are necked down to provide greater strength at the section where failure is most likely to occur. The head of the exhaust valve has also been redesigned to provide greater flexibility and more uniform distribution of stress.

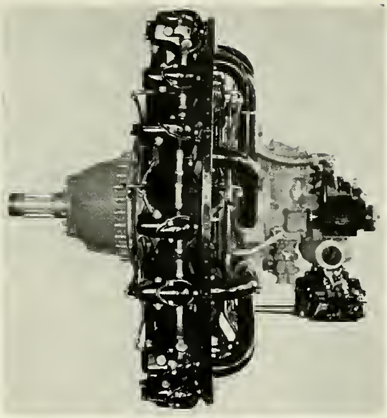
Pistons and rings are more rugged and are designed for better cooling. Pressure baffles, developed by Pratt & Whitney, are independently supported on the cylinders by quick detachable spring clips which add flexibility and durability. A cylinder can now be removed by disturbing only the adjacent baffles.

A new cam and cam drive mechanism, which permits the valve gear to be operated at higher speeds with the same degree of safety, is provided in the E Hornet. The cam is mounted on and rotates about an annular pedestal or shoulder on the front face of the crankcase. This arrangement simplifies construction, reduces the angularity of the push rods, provides an outboard bearing for the cam intermediate gear and adds greater strength to the crankcase.

A single-row, two-piece crankshaft, split in the center of the pin, is employed. Its rear section telescopes into the front half and is held in angular relation by an increased number of splines, which have added to the ruggedness of the shaft and have made the crankpin more nearly a homogeneous unit.

Crankshaft roller bearings have been improved by slightly crowning the rollers to prevent crushing the bearing races at the edges of the rollers. Although of the same type, the design of the reduction gear has been simplified over previous Hornets. Greater manufacture precision has enabled elimination of the previously-used pinion gear, equalizing mechanism without sacrifice in reliabilty. Pinion gears are now supported on plain lead bronze bearings instead of needle bearings, an arrangement which also makes for simplicity.

A newly designed sump for use with the automatic rocker box lubrication system, has been adapted. An additional sump compartment, into which the oil from the rocker boxes drains insures complete removal of oil from the boxes, thus facilitating starting and providing for smooth running. The control valve for the Hamilton Standard controllable-pitch propeller has been removed from the nose section (as in former models) to the rear face of the sump.


Side view of the P. & W. S1E-G Hornet

A new type hot spot is part of the E Hornet's standard equipment. Exhaust gases are passed through a stainless steel manifold cast in an aluminum housing. The heated streamlined tube, passing through the center of the mixture passage, produces excellent vaporization with low loss of power, thus adding to the efficiency of the engine. Because of its compactness, this hot spot facilitates installation of a top air intake.

Every effort has been made to prevent oil and grease leaks and to approach, as near as possible, complete tightness in every detail. Additional thickness has been applied to the flanges on oil pipes, accessory covers and cover plates to prevent warping. Rubber inserts have been provided on cylinder flanges and between crankcase flanges to achieve the resulting oil tightness. A one-piece push rod cover with packing glands and nuts at each end aids toward oil tightness.

Specifications of S1E-G Hornet engine:

Horsepower	750 h.p. at 7,000 feet
Propeller ratio	3:2
Compression ratio	6.5:1
Blower gear ratio	12:1
Overall diameter	54.437 inches
Overall length	51 inches
Bare weight	1,005 pounds

• Recent Aeronautical Patents •

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W. Washington, D. C.

Aircraft sustaining rotor construction. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (1,980,169)

Wind tunnel balance. William F. Gerhardt, Grosse Ile, and Clarence A. Brock, Detroit, Mich., assignors to Deven Corp. (1,980,195)

Airplane. William A. Stout, Detroit, Mich. (1,980,233)

Airplane sky sled. Gene Austin, Minden, La. (1,980,246)

Automatic variable-pitch propeller. Harrison Bates, Denver, Colo., assignor to Bendix Research Corp. (1,980,248)

Propeller. Harrison Bates, assignor to Bendix Research Corp. (1,980,249)

Propeller. Clinton H. Havill, South Orange, and Martin Mansson, East Orange, N. J., assignors to Eclipse Aviation Corp. (1,980,272)

Bomb-releasing device. Leland D. Bradshaw, March Field, Calif. (1,980,375)

Inclination gauge. David S. Klauder, Jr., Wyomissing, Pa. (1,980,487)

Propeller. Charles G. Eckhold, Overland, Mo. (1,980,717)

Method of making a propeller. John Squires, Hagerstown, Md. (1,980,834)

Device for regulating pitch of variable-pitch propellers during flight. Louis Breguet, Paris, France. (1,980,847)

Aircraft construction. Edgar L. Matlock, El Paso, Tex. (1,980,869)

Device indicating flying altitude of aircraft. Remi Talafre, Paris, and Henri Renault, La Garenne-Colombes, France. (1,980,886)

Aircraft having sustaining rotors and method of operating same. Harris S. Campbell, Hatboro, Pa., assignor to Autogiro Co. (1,890,980)

Aircraft having sustaining rotors. Agnew E. Larsen, Huntington Valley, Pa., assignor to Autogiro Co. (1,980,999)

Mooring mast. Charles E. Rosendahl, Lieutenant Commander, U. S. Navy. (1,981,005)

Multimotored airplane. Allan H. Lougheed, Los Angeles, Calif., assignor to Alhambra Airport & Air Transport Co., Denver, Colo. (1,981,237)

Airplane. Frank R. White, Glenn Dale, Md. (1,981,441)

Uninflammable balloon. John Letourneur, Versailles, France. (1,981,600)

Aircraft. . Raoul J. Hoffman, Chicago, Ill. (1,981,700)

Flying wing. Raoul J. Hoffman. (1,981,701)

Retractable landing gear. Hugh C. Downey, 1st Lieutenant, Air Corps, U.S. Army, Mitchel Field, N. Y. (1,981,856)

Airplane brake. Lewis J. Tetlow, Holyoke, Mass. (1,982,035)

Mounting means for aircraft sustaining rotors; Agnew E. Larsen, assignor to Autogiro Co. (1,982,113)

Valve for airplane engines. Feri A. Thaheld, Dallas, Tex., assignor to Guiberson Diesel Engine Co. (1,982,126)

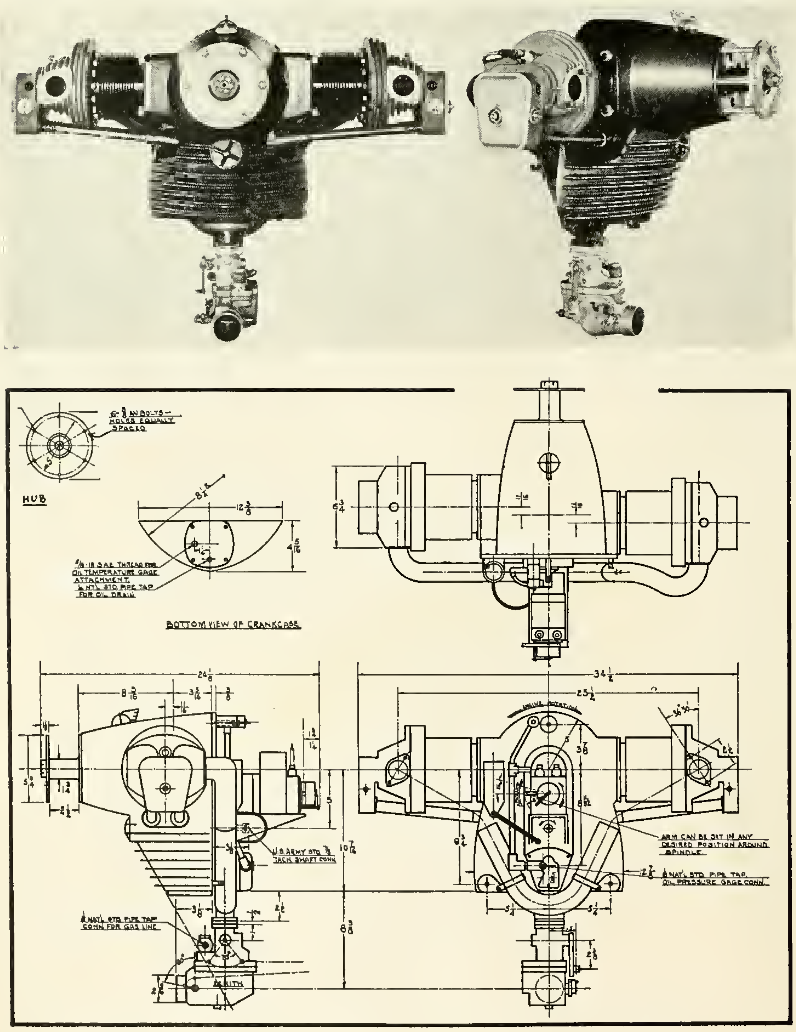
The New Aeronca 40 h.p. E-113B Engine

● The new Aeronca E-113B manufactured by the Aeronautical Corporation of America to supersede the E-113A, is a two-cylinder, horizontally opposed engine having a piston displacement of 113.5 cu. in., a bore of 4.25 in., and a stroke of 4 in. The compression ratio is 5.4:1 and the weight of the complete engine (including propeller hub) is 121 lbs. The engine has a Department of Commerce rating of 36 h.p. at 2400 r.p.m. and a manufacturer's rating of 40 h.p. at 2500 r.p.m. This rating is based on a 73 octane anti-knock rating fuel. The E-113B is the first aircraft engine having Quill or needle bearings on the crankpins to be approved by the Department of Commerce.

To increase the strength of the crankshaft and to reduce deflections in the bearings, the newly-designed crankshaft assembly is completely finish ground. Crankpins and crank arms have been enlarged and new-type counterweights and internal hex head-design counterweight bolts used. The crankshaft is machined from a 5% nickel steel forging and the crankpins are case-hardened and act as the inner race of the Quill bearing. The keyway has been made shallower and round Whitworth threads are used at the thrust bearing for the lock nut.

The connecting rod has been redesigned for the Quill bearing. It is a 3.5% nickel steel forging with a split big end bearing, case-hardened and acting as an outer race of the Quill bearing. The I-section of the connecting rod has been increased to take care of the slight eccentricity introduced by increasing the width of the connecting rod at the big end.

The Quill bearings, which are approximately ⅛" in diameter, are made of high-grade steel and have special conical ends to fit in the radii of the crankpin. There are fifty Quill rollers in each of the connecting rod bearings and the entire space is filled, as no bearing retainer or cage is used with this type of bearing.


6-⅜ AN BOLTS—
HOLES EQUALLY SPACED
HUB
4/8-18 S.A.E. THREAD FOR OIL TEMPERATURE GAGE ATTACHMENT.
¼ NAT'L STD PIPE TAP FOR OIL DRAIN
BOTTOM VIEW OF CRANKCASE
U.S. ARMY STD ⅞ TACH. SHAFT CONN.
⅛ NAT'L STD PIPE TAP CONN. FOR GAS LINE
ZENITH
ENGINE ROTATION
ARM CAN BE SET IN ANY DESIRED POSITION AROUND SPINDLE
⅛ NAT'L STD PIPE TAP OIL PRESSURE GAGE CONN.

Installation drawings and views of the Aeronca 40 h.p. engine

Permite aluminum alloy, used in the redesigned piston, is cast in a permanent steel mold, thus eliminating sand holes and insuring good balance and smooth surface inside the piston, the upper end of which is heavily ribbed. There are two ⅛" compression rings located close to the top of the piston and directly below them is one 3/16" oil ring. Due to the change in piston rings the piston skirt has been lengthened to reduce the tumbling of the piston in the cylinder. A closer clearance is also maintained between the piston and the cylinder.

A new full-floating piston pin made of S.A.E. 4615 steel is used. The hole is tapered to obtain great strength with the least amount of weight. The piston pin is retained in the piston by two small snap-rings, fitting in grooves in the piston at either side.

The main part of the crankcase section is a single streamline-shaped heat-treated aluminum alloy casting containing the one-gallon capacity oil reservoir in the lower part. The front side of the crankcase is finned to allow the airflow to cool the oil during warm weather, but this section can be covered by a metal shield during cold weather to maintain proper oil temperature. The main crankcase section contains the front ball thrust bearing, the forward main roller bearing of the crankshaft, and the four-lobed camshaft which is mounted in two ball-bearings. Cam follower housings, also in the crankcase, are made of Permite aluminum alloy in a permanent steel mold.

Accessory drives are at the rear of the engine. The heat-treated aluminum alloy backplate, which is attached to the rear of the crankcase, contains the rear main crankshaft roller bearing, the accessory drive gear train and oil relief valve. The aluminum alloy gear cover attaching to the backplate contains the oil pump, tachometer and magneto drives.

Cylinder heads, of heat-treated cast aluminum alloy, contain the rocker arm housing as an integral part. Valve seats are of aluminum bronze forgings, shrunk into the head and valve guides are aluminum bronze also shrunk in. Heads are bolted to the steel cylinders.

Cylinders are machined from chrome-molybdenum steel forgings, heat-treated. Valves are of the full tulip head type made of Diachrome steel and the intake and exhaust valves are interchangeable. Double valve springs, each coiled in opposite directions, are on each valve.

Each rocker arm is mounted on two

ball bearings. Rocker arm bearings and outer push rod sockets are lubricated thru Alemite Zerk fittings on the end of each rocker arm shaft. Push rods, of dural with hardened steel ball ends, are enclosed in aluminum push rod tubes.

A low pressure oiling system can be used on the new Aeronca engine, as the major bearings are either ball, roller, or Quill bearings which require little oil, and in cases of emergency, can operate without oil for a short time.

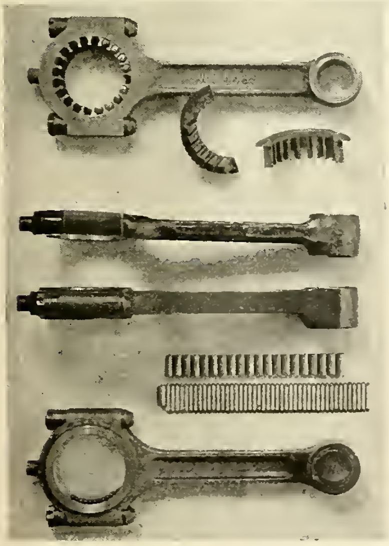
Oil is taken from the oil reservoir in the bottom of the crankcase thru a screen by the oil pump mounted in the gear cover and from there is forced thru the all-metal Cuno oil filter to the crankpin bearings. This oil line also goes to the oil relief valve at the top rear of the engine and to the oil pressure gauge connection. From the oil relief valve, excess oil flows into the front nose section of the crankcase which is separated from the cylinders by a wall and from there into the oil reservoir. By allowing the oil to flow thru this section of the crankcase, the front thrust bearing is oiled and heat is taken from the front main roller bearing and the center wall of the crankcase.

Oil from the crankpin bearings lubricates the cylinder walls and the camshaft bearings and then collects in the interior sump from where it is removed by the scavenger oil pump to the oil reservoir.

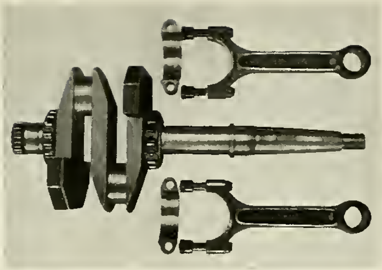
Normal oil pressure is 9 to 13 lbs. gauge and the level in the oil reservoir can be checked by the sight gauge on the top left side of the crankcase.

A rather elaborate breathing device is necessary for this engine so that it will remain clean and will lose no oil due to the compression caused by the two pistons traveling inward, simultaneously.

This device consists of a small flapper valve which allows the air to flow only in an outward direction from the interior of the crankcase into the oil separator. The oil separator is designed to prevent the loss of oil into the atmosphere while at the same time allowing the air to escape. The oil is deflected downward in the separator and drains from the bottom thru an oil line into the crankcase proper and thru a ball-check valve. The air is allowed to escape upward thru the separator and out thru a metal screen. This device produces a slight vacuum in the crankcase which is not only desirable in preventing oil leaks at various joints on the crankcase, but also draws oil out of the separator by the ball-check valve.



Comparison of old (upper) and new (lower) Aeronca connecting rods and bearings



Aeronca crankshaft and rods

A Bosch FF2AR magneto, with an impulse coupling for easy starting and a Zenith type 156 AL carburetor are used. Spark is controlled automatically by a lever connecting with the throttle on the carburetor, an arrangement which reduces engine stresses, producing smoother action and allowing slow engine speed when landing the airplane. The carburetor has an aluminum body and a vacuum controlled economizer valve and accelerator pump.

ENGINE DESIGN LIMITS

(*Continued from page 27*)

bricants should be investigated.

(2) Propeller drive requirements do not directly limit the rotative speed, but may constitute a limit of piston speed, mean effective pressure, and number of cylinders for ungeared engines.

(3) Because of cooling limitations on air-cooled engines, the larger engines should be rated at a lower piston speed.

(4) Because of cooling limitations on the mixture ratio and because of the necessity of using lower compression ratios in larger engines, the overall efficiency of the smaller engines will be higher, *if a proper lubricant is used.*

The principle is a useful if somewhat neglected tool which will undoubtedly yield other practical information on the limitations of the output and efficiency of aircraft power plants.

Ed. Note.—This paper was presented by the author at the June, 1934, meeting of the Society of Automotive Engineers at Saranac Lake, N. Y.

Digest of Foreign Technical Articles

(*Continued from page 39*)

Buckling of Beams

The Buckling of a Linked Beam having Strength in Flexure and Shear, R. A. Fairthorne. (British) Aeronautical Research Committee—Reports and Memoranda No. 1616, *January* 30, 1934 (*published December* 1, 1934), 6 *pp.*, 3 *figs.*

THE INVESTIGATION described follows one in which the behavior of a simple model beam, rigid in flexure but capable of shear, was determined. For this report, the model was modified to include flexural deflections as well as shear, the stability being considered for a linked beam under end load, first for flexure and then for flexure and shear. It is shown that, if the flexural and shear strengths are properly defined, the formula, giving the modified Eula buckling load in terms of the usual buckling load and the shear constant, applies to a lattice beam. The author suggests that the method may be of use in obtaining by an arithmetical process, reasonable approximations to the buckling loads of homogeneous struts of variable cross section.

Aerodynamics

The Lift and Drag of a Wing Spanning a Free Jet, H. Glauert. (British) Aeronautical Research Committee—Reports and Memoranda No. 1603, *March* 27, 1934 (*published December* 1, 1934), 8 *pp.*, 2 *figs.*

THE THEORETICAL formulas given have been developed as a preliminary step to experiments in the large wind tunnel on airplanes whose wings will project beyond the boundary of the free jet, in order to determine the magnitude of the induced drag of a wing under these conditions. The formulas given are for calculating the distribution of lift across the span of a wing which extends across the diameter of a free jet and corresponding induced drag, while the numerical results are derived for untwisted wings of constant chord.

It was found that the effective aspect ratio of such a wing is only slightly greater than one-half of the aspect ratio of the part of the wing in the jet.

Avigation

Some Recent Methods for Obtaining Astronomical Points in Flight (De quelques procedes recents de points astronomiques in vol), A. Bastide. L'Aéronautique (L'Aérotechnique supplement), Vol. 16, *No.* 185, *October*, 1934, *pp.* 89-97, 21 *figs.*

A CRITICAL discussion of new methods developed for determining an astronomical point in aerial navigation is given. The author explains the principle involved in each and the method of operation, criticizing them from the point of view of simplicity, rapidity and precision. He covers the logarithmic and tabular methods proposed by Severino, the logarithmic method of Gingrich, the graphic methods of Simeon, Galante and Kahn, the mechanical procedure with the spherant, and the mechanical-graphic methods of Loth and Guyot.

British Research

Report for Year 1933-34. (*British*) *Aeronautical Research Committee*, 89 *pp.*, 4 *figs.*

A REVIEW of the progress in new research equipment and investigations in safety for aircraft and engines by H. T. Tizard introduces the more detailed reports of the subcommittees. Research developments undertaken during the year by the Committee cover aerodynamics, fluid motion, stability and control, servo controls, spinning, seaplanes, atmospheric turbulence and meteorology, structures, aircraft noise, engines, elasticity and fatigue and alloys.

Outstanding in the engine review was the opinion that the sleeve-valve engine is peculiarly suitable for high supercharging and since the chief constructional difficulties have been overcome, its use on an extended scale is expected. Proposals are also made for replacing gasoline-engine carburetors by injection pumps. Considerable research on magnesium alloys for aircraft has also been undertaken as well as on casting duralumin and in experiments with beryllium.

Metal Corrosion

The E.M.F. between Metals in Seawater, J. W. Willstrop. (*British*) *Aeronautical Research Committee—Reports and Memoranda No.* 1611, *June*, 1934 (*published December* 1, 1934), 10 *pp.*, 1 *fig.*

ELECTROLYTIC CORROSION, which occurs when two dissimilar metals connected by actual contact or a third conducting metal are immersed in sea water, was investigated. The potential differences, or e.m.f., were measured and a calomel electrode taken as standard. Of the metals tested, stainless steel of the 18-8 type and monel metal were the most positive, followed in order by brasses and bronzes, "Twoscore" stainless steels, 13 per cent chromium steels, duralumin and copper-content aluminum alloys, ordinary steels, aluminum alloys free from copper, cadminum, zinc and finally magnesium alloy D.T.D.88 which was the most negative of the metals tested. The author concludes that the use of metals of widely different potentials in contact is liable to result in serious corrosion of the more negative metal, especially where saline water is likely to be encountered.

Airplane Performance

A Diagram of Comparison for Rapidly Predicting the Performances of an Airplane (*Abaque de comparaison pour le calcul rapide des performances d'un avion*), *R. Gibert. Revue Générale de L'Aéronautique, No.* 18, 1934, *pp.* 1-42, 16 *figs.*

FOUR APPLICATIONS of comparison diagrams are given for evaluating airplane performance. The first applies to an airplane of known characteristics with a known engine and propeller when it is desired to predict new performances with another known engine, and also with another adaptation of a propeller. The second applies to a standard airplane of a determined weight when the performance with a different weight is desired. The new performance of the third airplane is required when it differs from the first by the size of its lifting surfaces. The fourth application is a combination of the preceding for use with: changing engine and weight; changing engine and lifting surface; differing in total weight and lifting surface; and changing engine, weight and surfaces. The author also gives an analytical study of the performance for a series of airplanes derived from the same prototype but with the same propellers.

Propeller-Body Interference

Interference between Bodies and Airscrews, Part II, C. N. H. Lock and H. Batemen. (*British*) *Aeronautical Research Committee—Reports and Memoranda No.* 1522, *August* 13, 1932 (*published September* 18, 1934), 27 *pp.*, 8 *tables*, 3 *figs. on supplementary sheets.*

EXPERIMENTAL data is analyzed to ascertain the general effect of changes of body and propeller. Additional data obtained on the 3:1 fineness-ratio body is included. The last part of the report is devoted to a strip theory analysis of the pusher combinations. Results were consistent with the conclusions that the direct spoiling drag is largely suction at the tail produced by rotation of the slipstream, and that the presence of a propeller fairly near the excrescences reduced the drag associated with their turbulent wake. In regard to power required to drive the propeller, it was proved that there was no appreciable direct loss of energy associated with the central sections of propeller blades even when these are in the turbulent wake of the body and annular excrescences.

Wing Flutter

The Flexural-Torsional Flutter of a Simple Cantilever Wing, D. Williams. (*British*) *Aeronautical Research Committee—Reports and Memoranda No.* 1596, *November*, 1933 (*published November* 15, 1934), 18 *pp.*, 6 *figs. on supplementary sheets*, 6 *tables.*

EFFECT ON the flexural-torsional flutter speed of a typical wing was investigated by varying such factors as the ratio and absolute values of the elastic stiffnesses, position of the flexural axis and of the principal axis of inertia, density of the air, or flying height, weight of wing per unit area, and the elastic hysteresis. The author concludes that the ratio of torsional to flexural elastic stiffness should be as large as possible and that for all positions of the flexural axis aft of about 0.27 of the chord, the location of the principle axis of inertia forward of the flexural axis is sufficient to prevent flexural-torsional flutter. A high value of air density was found to be deterrent to flutter, while a low value of wing weight per unit area was favorable towards producing immunity from flexural-torsional flutter in all cases. It is shown how a rough estimate may be obtained of the flutter characteristics of other cantilever wings by the use of the diagrams given.

Rocket Propulsion

Propulsion by Reaction (*Propulsione a reaziane*), *G.A.R.I. Italo Raffaelli. Rivista Aeronautica, Vol.* 10, *No.* 6, *June*, 1934, *pp.* 463-472, 12 *figs.*

POINTING OUT that technical literature on this subject contributes little of value and sometimes leads to errors especially in definitions of efficiency, the author takes three distinct cases of propulsion by reaction and derives formulas and curves for deducting the corresponding efficiencies. The first case is one in which the movable object is rushed through the surrounding air by burning the combustible existing in it and by creating the energy to impress to this air an increment of velocity, opposite in direction to the motion produced. In this case the object has a hollow tube such as the tubular fuselage. In the second case the moving object utilizes solely the mass and energy which it has on board without help from the surrounding air. In the third case, the moving object during the course contains the mass in contact with the surrounding air and drags it with it in order to expel it afterwards with a velocity of defluxtion.

Glider Performance

Effect of the Aerodynamic Form on the Performance of Gliders (*Einfluss der aerodynamischen Gestaltung auf die Leistung von Segelflugzeug*), *A. Lippisch. Luftfahrtforschung, Vol.* 11, *No.* 5, *October* 25, 1934, *pp.* 122-127, 21 *figs.*

PERFORMANCE OF a glider is determined with the aid of the velocity polar, which indicates the connection between the horizontal and sinking speed, and the relationship between these two speeds is derived, the average sinking speed in a given speed range being found. A basis for arriving at the most favorable type of glider in regard to continuance of flight is formed. From the equations it is shown that gliders are to be preferred which have a higher wing loading at the most favorable gliding angle. Development of high-performance gliders by the German Research Institute for Gliders is discussed and the form of the Fafnir II is explained, with performance measurements of the "Obs" and Fafnir II.

This article is supplemented by one determining the effect of weight and drag on the sinking speed and the lift-drag ratio of gliders, by B. Kosin.

Gatty Ground Speed Meter

●

Lt. Comm. P. V. H. WEEMS, U.S.N. (Ret.)

● A ground speed meter based on the principle of the stroboscope was first used by Harold Gatty on the proposed Gatty-Bromley trans-Pacific flight in 1930. For his Round-the-World Flight with Wiley Post in 1931, Gatty developed and used a more refined instrument with which not only ground speed but drift also could be observed from inside the plane. The excellent performance of the device on that flight resulted in the purchase of Government rights by the U. S. War and Navy Departments and in its further development by the Air Corps and the Bureau of Aeronautics.

The basic principle of the newest ground speed meter is a constant-speed film that is synchronized with the apparent motion of the ground by varying the height of the eyepiece above the film. Two sections and the mathematical principle of the device are illustrated in figure 1, the front section showing how the film is carried over a prism by a clockwork. The film is marked with parallel lines at right angles to the motion of the film. The side section in the same figure shows how the instrument is mounted in the plane, with a periscope for viewing the ground while observing from inside the plane.

In the similar triangles in figure 1, the film speed, altitude above the ground, and height of eyepiece above the film are known factors, while the ground speed is to be found. In the two triangles,

Ground speed/film speed = altitude/eyepiece scale, or,

Ground speed = film speed × altitude/eyepiece scale

The values are so chosen that a simple division with a small correction for the drift angle at once gives the ground speed.

Observations may be made under usual conditions directly on the surface of the water without the necessity of dropping smoke bombs. In actual operation, the altitude is read, or, if flying at an unknown elevation, by flying down and measuring upward the exact altitude above the ground or water surface.

The ground is observed through the eyepiece and the clockwork is started. There will be a difference between the apparent speed of the film and the rate at which the ground is moving across the prism, so that the eyepiece must be moved until both speeds are equal, that is, until the film movement is synchronized with the apparent movement of the ground. Particularly over water, where there are no objects to time, the fact that a moving mass is observed is of great value.

The Gatty instrument was considered the best available ground speed and drift meter by Col. Lindbergh and was used by Mrs. Lindbergh on their 30,000-mile flight around the Atlantic. Observations were made over the Greenland ice cap as well as over land and over water. Since the Lindbergh plane was not on a fixed schedule and, when once committed to a flight it was usually necessary to complete it regardless of the speed made or the time consumed, the ground speed was not as important as the drift. The drift feature of the device proved highly satisfactory on the flight and observations for drift were made regularly, even when speed observations were not required.

While Gatty, Mrs. Lindbergh and others have used this instrument with success, it is new and will doubtless be further developed and refined.

As pointed out by Gatty, the disadvantages of this device are that it is necessary to be able to see land or water and also make an accurate determination of the altitude above the surface.

If the barometric altimeter is corrected for temperature the error over water is slight, and, if one is in doubt, it is always possible to fly down close to the water and reset the altimeter.

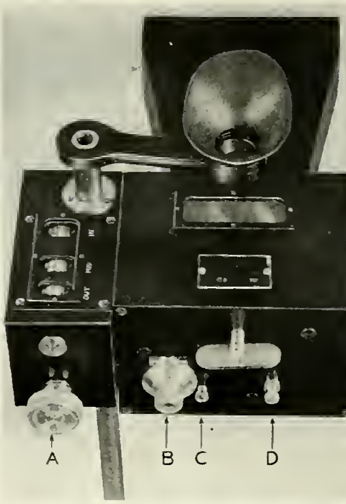


Fig. 2. Gatty ground speed and drift meter. A—Knob for raising and lowering eyepiece. B—Knob for drift measurement. C—Gear shift button to permit use of 3 speeds. D—Start and stop button for clock mechanism

On the first thorough test of the instrument by the writer, the results shown in the two tables below were obtained:

These results are considered good, but the total errors may not be solely due to the observed ground speed and drift errors since other factors such as picking the course from the chart, etc., enter into the total errors. Gatty claims an overall accuracy to within .5° in course, and 1 m.p.h., in speed. If these errors were doubled or even trebled, the value of the instrument is apparent.

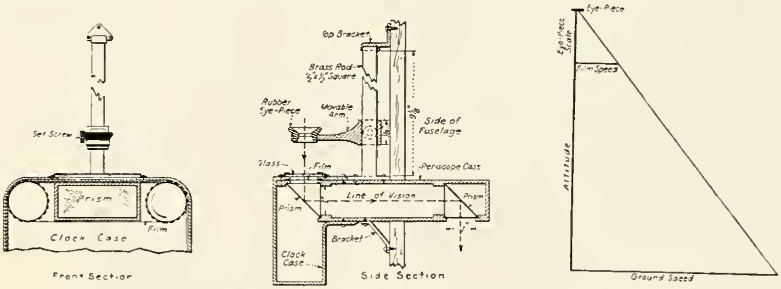


Fig. 1. Principle of the Gatty ground speed and drift meter

1st Leg of Course	
Ground speed measured (m.p.h.)	131.6
Ground speed made good (m.p.h.)	130.0
Speed error (fast)	1.2
Course computed by measuring drift	191.0
Course made good	191.5
Error in course (left)	0.5°

2nd Leg of Course	
Ground speed measured (m.p.h.)	104.6
Ground speed made good (m.p.h.)	111.0
Speed error (slow)	6.
Course computed by measuring drift	352.0
Course made good	352.6
Error in course (left)	1.6°

Person**air**lities

By Caldwell

● MANY OF our citizens who have achieved fame and fortune were small town boys; and a sure sign of their impending fame is that at the very first opportunity they shake the dust of the dear old home town from their shoes or their bare feet and journey to a city where life is so much easier that before you can say Scat they have climbed to the top of the heap and have flocks of city fellers working for them. Walter Chrysler the automobile wizard, for example, was born in Wamego, Kansas. I'll bet you never heard of it before! And so was Dean Farran—perhaps you haven't heard of him, either. But if Wamego, Kansas, was good enough for Walter Chrysler, it was good enough for Dean Farran. Of course, both of them got away from it as soon as they could, and if you've seen Wamego you won't blame them; you can fly right over it in a few seconds; in fact, unless you look sharp you won't even see it.

Dean was born on New Year's day, 1892, but instead of going to Detroit like Mr. Chrysler, he went to California, where the chief industries are oil, fruit, movies, real estate, politics and deluding Aimee Semple McPherson's congregation. Instead of going in for these sound, money-making businesses, Dean got mixed up with wireless in 1907; he also got a lot of miscellaneous technical education at the Los Angeles Polytechnic High School, between 1906 and 1910, which unfitted him to become a real estate salesman or a member of the Chamber of Commerce. So he built a wireless station of his own, and in 1909 was a commercial wireless operator.

If Dean had just stuck with wireless and ridden along with it until it became radio, to-day he might have owned the Radio Corporation. But it happened that when Los Angeles put on an air meet in 1909, Dean built a wireless station at Dominguez Field and sent the newspapers red hot news about the flights. This was real pioneering, but it was also very unsettling to an imaginative youth from Wamego. Seeing all those planes tearing along at from 30 to 50 miles an hour was too much for him; he broke down and, with three other aerially smitten youngsters, built a glider. Anyone who is familiar with the history of youths who built gliders knows that thereafter they are definitely headed away from fame and fortune. It isn't that building the glider weakens them physically, and it isn't that they receive injuries in a crash (for the thing seldom flies) but there must be something unsettling about the contraption that permanently unfits them for lucrative labor. Walter Chrysler never built a glider or he wouldn't be the man he is to-day. He has no pictures of early gliders, but he owns the Chrysler Building in New York.

After this lapse from sanity, Dean Farran reformed and decided to stick to radio; he operated the ship and shore stations of the United Wireless Telephone Co., and the experimental stations for Dr. Lee de Forest. He also practised architectural and structural engineering, and for a time it looked as though his unfortunate lapse with the glider would have no ill effects. But just then the war came along, the one in which all the nations practised up for the next one, and Dean served in the U. S. Army air service as pilot and radio officer. From that time on he has never been able to make up his mind whether he's in radio or aviation, or half and half. After learning to fly in the Army (he just flew, he didn't do any fighting) he got out and engaged in structural engineering from 1919 to 1921, then went into the wholesale radio business and became a radio consultant from 1922 to 1926. You could ask him anything and he'd answer you just like that. In 1922 he built the first KHJ broadcasting station in Los Angeles, and to this day there are people who haven't forgiven him for it. He has done much experimental work on aircraft radio, including the equipment for Ernie Smith and the grim-faced Emory Bronte who flew the first civilian ship to Hawaii. Later the same receiver went to Hawaii with Art Goebel and Bill Davis. As for Dean, the only time he really needed a radio in an airplane himself was when he flew from Los Angeles to Ecuador, got to Panama, and found that he was in for a 500 mile water jump. And he had no radio!

Dean Farran's pencilled self-portrait

In 1927, running true to type as an early glider builder, Dean Farran pulled off a Jekyll and Hyde change and emerged as communications officer in the U. S. Army Air Corps at Crissy Field, San Francisco, the most northern suburb of Los Angeles. Then he was commanding officer at Clover Field, Santa Monica, where Douglas transports are built. In 1928 Dean leaped back into civilian life and now holds a commission as Captain in the Air Corps Reserve. But flying had unsettled him for radio, so in 1929 he went with Pickwick Airways. He made a survey of the Pickwick Latin-American Airways and helped to get them in operation. He is now Test Pilot for Airplane Development Corp'n of Glendale, Cal., which builds the fast Vultee transports, in which, a couple of months ago, I had a rather startling flight. Old Massa Farran, the glider builder and radio technician, had brought the ship east and had then succumbed to an attack of the grippe. These Californians can't take our New York climate, which is compounded of equal parts of rain, fog, smoke, mud, and clam juice; in fact, it is our proudest boast that if you can live in New York you can live anywhere —if you don't mind coughing.

Anyhow, Dean was laid up and a pilot named Earthbound Kelly was at the controls of the Vultee—I named him Earthbound in appreciation of his technique. We flew from Roosevelt Field to Riverhead, out on Long Island where they raise the ducks. After we landed the weather closed in, but phone calls informed us that there was plenty of ceiling at Mitchel and Newark, so we took off with the bold Kelly clutching the controls. Aboard the craft, in addition to Jerry Vultee and several guests, was about every device of modern air navigation that the mind of man could conceive, including compasses, bank and turn indicators, artificial horizons, and radio. Mr. Kelly ignored them. Instead of going up through the clouds to clear air, he stayed down, and I mean *down.* For 30 miles we never got above 30 feet. Over the tops of houses and telephone poles we had 30 inches, or possibly less. Many a famous Long Island duck will remember that flight to his dying day. So will all the passengers; their eyes stuck out so far you could have knocked them off with a stick.

Farm after farm, complete with thousands and thousands of terror stricken ducks, slid immediately beneath our wings, with ducks tearing frantically off in all directions. If I'd been down with the ducks, I'd have been getting out from under too. We passed over small villages along the shore; and as we passed horses reared up in their harnesses, people ran out of houses, and all was confusion. Then in a moment we'd leave the village behind and again be with the ducks; I saw millions of ducks that day, and they were all moving rapidly. There are no slow ducks on Long Island.

After 30 miles at 30 feet, Earthbound apparently decided that he couldn't make it; he did a steep bank and got back on his return course. Ducks that had been merely frantic on our outward journey became insane on our return tour of depredation; I saw at least six of them fly up into small trees, which is a thing that no sane ducks are supposed to do. At one place I got a brief glimpse of ducks streaking into the house—not the duck house, the farm house. It was, as they say out in Hollywood, Colossal. And then some. I had been wishing fervently that I had led a better life and had more insurance, for I had lost faith in Earthbound, when a comforting thought occurred to me: pilots like that weren't born to crash, they were born to be hung. There wasn't a doubt of it! Thereafter I rested easily, knowing that luck would bring us down safely eventually. And it did. We ran out of ducks, we ran out of any recognizable landmarks, we missed Riverhead—if that was where we had been making for—but we did run into a clear blue patch, quite a small patch. Good old Earthbound! He made for that spot, flew up it, came out in sunshine, flew along to Roosevelt, and landed us in a rainstorm. Earthbound, you've taken a year from my life, but I forgive you. I learned about ducks from you. And some day they'll pick you off a tree and crate you!

● MY GOOD friend Roy O. Hunt, who was born in Oklahoma on May 29, 1897, and gradually raised all of 5 feet 3 inches above the soil of that state by the time he'd got his full growth, writes to say that he has joined the ranks of pilots who are sitting beside an airplane wondering what to do with it to achieve a modicum of fame and fortune. It is the Lockheed Orion of Mr. F. C. Hall of Oklahoma City beside which the Aeronca-sized Mr. Hunt is reclining, his brow furrowed with the unaccustomed labor of deep thought.

What original thing remains to be done with an airplane these days, anyhow? What can any pilot do that is not merely an extension of or a slight improvement on something that some other pilot already has accomplished? He might go in for altitude flights, or ocean-flying, or globe-girdling; but Wiley Post is working on altitude, so is George Haldeman; ocean flying in landplanes still seems to me just another useless stunt; and flying rapidly around the Northern Hemisphere, while it is a very difficult and wearing task to accomplish, is too reminiscent of a kitten chasing its tail, running around in dizzy circles and ending up where it began. Whatever he does, I hope Roy will avoid oceans; the only sensible way to fly over them is in Zeppelins, or large, expertly-navigated flying boats, or in a glider hitched to the rear end of an ocean liner, so it won't get lost.

In an effort to be helpful, I would advise Roy and his backer, the kindly and generous Mr. F. C. Hall who backed the World Flight of Post and Gatty in the *Winnie Mae,* to consider the lessons of the MacRobertson Race from England to Australia, which gave the world one of the most interesting and valuable demonstrations of the sane application of aviation that it has ever received. It seems to me that it would be a remarkably fine accomplishment for an American pilot to call attention, by means of a record-breaking speed flight, to the air transport system that links North and South America—Pan American Airways. One such flight would do more to advertise the airline facilities already available than would two years of patient publicity work and advertising — even though Pan American's commercial transports are flying at no such speed and would not be expected to. Furthermore, such a flight would be a spectacular and friendly gesture to our sister republics of South America—and one smiling air pilot is worth more as a good-will ambassador than 50 diplomats. Pilots haven't started wars; diplomats have.

Roy O. Hunt. Can that lad stunt!

Roy O. Hunt (the O is for Orlando) worked his way through school, completed a course at an automobile trade school, worked at the automobile repair business, in 1918 enlisted in the Signal Corps, U. S. Army, and was stationed at Orley, France, on experimental work. After the war he was an electrical engineer for the city of Hinton, Okla., for two years, then again returned to the automobile business, but in 1926 he became a barnstormer. That was the first time he went in for sitting beside an airplane, wondering what to do with it, while one farmer and three small boys sat around loafing too. In Sept., 1929, he left the coffee and hamburger circuit to serve as an instructor for the Curtiss-Wright Flying Service at Oakland and Alameda, Calif., until May, 1930. In February of that year a ship he was flying lost its wings, and Roy joined the Caterpillar Club. He also had joined the N.A.A., with less excuse.

During the next three years Roy went in for an endurance refueling flight record but was forced down after 292 hours; at Dubuque, Iowa, he raised the world's consecutive outside loop record from 78 to 124, July 5, 1931; and then he became manager of the Norman Flying Service at Norman, Okla., and air service representative of the Oklahoma Highway Commission. He won the Cord Trophy race in 1932, and last year at the National Air Races, with Art Davis, he put on a demonstration of air fighting and sky-writing that was a model of expert and sensational flying. Recently he has been flying as a Deputy Sheriff, reporting to Oklahoma police cars by two-way radio if he discovered any bandits. He didn't discover any. Neither did the police.

Roy has named his plane *Sheridan,* after Mr. Hall's little grandbaby, the daughter of Winnie Mae Fain, who is Mr. Hall's daughter, after whom Post's ship, the *Winnie Mae* is named. If Roy flies to the South with *Sheridan* he'd better make it plain that he hasn't named it after *General* Sheridan, who commanded the Army of the Shenandoah in the Civil War. "De wah" is still remembered down there, and so is General Sheridan.

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NEWS OF THE SCHOOLS

Michigan Gives Free Instruction

AVIATION GROUND Schools, sponsored by the Michigan Board of Aeronautics and established as a part of the Federal Relief Administration's Education Program, are being enthusiastically received throughout the state. It is the plan of the State Board of Aeronautics to have a ground school in all its larger cities.

Approximately forty are being established at once, and applications have been approved for schools, at Battle Creek, Benton Harbor, Saginaw, Escanaba, Flint, St. Ignace, Houghton, Allegan, Grand Rapids, Jackson, Marshall, Ypsilanti, Ann Arbor, Crystall Falls and Ironwood. The number of students indicating their desire to enroll in the schools at Flint and Grand Rapids is so large that it is probable that more than one class will be organized and it is estimated there will be more than 1,000 students enrolled in these classes within a short time.

The ground school courses include instruction in aerodynamics, theory of flight, aircraft engines, aircraft repairs, instruments and United States Department of Commerce regulations. No flying instruction is included.

Classes are held in public school classrooms two or three evenings a week for a total of 30 class periods. There is no charge for instruction, but each student is required to provide himself with a standard text adopted for use at all locations in the state.

Ryan Enrollment Heavy

THE RYAN SCHOOL of Aeronautics, San Diego, Cal., is enjoying one of the heaviest student enrollments in recent months, according to Earl Prudden. At the present time its student roster includes representatives from seven foreign countries in addition to representatives from practically every section of the United States. The majority of its new enrollments are for the complete transport pilot's flying course which the school offers with radio beam flying, instrument flying, amphibion training, night flying and 2500 miles of extensive cross-country experience as a standard part of its regular curriculum.

Students Form Seventh Club

A CHINESE Aero Club was organized recently by Lee Hong Tee, Harry Leung and Paul Sze, who are at present enrolled in the Rising Sun Aircraft School, Inc., Philadelphia, for the autogiro, airplane and engine master mechanics' course.

The forming of this unit brings the total up to seven Aero Clubs organized and still operating, by students of the Rising Sun Aircraft School, since last January. Each club has its own airplane.

The new group has purchased a Travel Air and will receive its flight training from Warren G. Nichols.

CURTISS STUDENTS BUILD MONOPLANE

STUDENTS OF the Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, Calif., under supervision of the faculty, have designed, and are now building a single-place, high-wing monoplane as a major problem in the school's regulation courses in practical training. The faculty outlined the basic design, engineering students developed the details, and when plans and specifications were completed, the latter joined the master mechanic class in the construction.

Will Build School-Designed Plane

MANUFACTURE OF a new light and inexpensive monoplane designed by two members of the University of Minnesota Department of Aeronautical Engineering is expected to begin within a short time at the Wold-Chamberlain Municipal Airport, Minneapolis.

The plane is a two-place, high-wing job designed for private use and training purposes. It is the result of the work of Prof. John D. Akerman, head of the university's department of aeronautical engineering and Howard W. Barlow, expert on streamlining and structures.

Stewart Tech Extends Course

STEWART TECH School, New York, N. Y., has extended the time of its Aviation Courses in Master Mechanics and Aeronautical Engineering. Classified by the Department of Commerce as properly equipped and conducted, full credit for time is now given Stewart Tech students toward eligibility for mechanics examinations. Graduates are qualified for the Department of Commerce Mechanics License.

Parks Enrollment Encouraging

ADVANCE REGISTRATION of new students in December at Parks Air College for the Winter term, which starts Jan. 7, indicates a total enrollment exceeding those of the 1934 school terms, according to Fred C. Parks, college registrar. A total of 194 students enrolled for the Fall term.

To accommodate the increased enrollment, the shops have been removed to the Administration building, which will provide 32,500 square feet of space.

Boeing Offers New Course

DESIGNED TO give a maximum training for a professional career in air transportation and featuring actual apprentice experience, the Boeing Airline Pilot and Operations Course has been developed at the Boeing School of Aeronautics, Oakland, Calif., as a two-year course.

Flight instruction, lecture and shop classes are conducted concurrently under a special schedule to provide a thorough background of the theory and practice of ground and flight operations.

A total of 250 hours of flying is offered in nine types of training planes. Through arrangement with United Air Lines, airline pilot students are not only given instrument and beam flying practice, but also receive training in beam landings.

The first year of ground school covers four quarters of training in practical shop work, engine overhaul and maintenance, aerodynamics, communications, air law, metallurgy, principles of air transportation, aerial surveying, meteorology, instruments and such fields.

The second year consists of four quarters of advanced work, covering training for field service mechanic's certificate, aircraft engine mechanic's certificate, airplane metal mechanic's certificate, radio electrician and operator's certificate, instrument service mechanic's certificate and/or applied design certificate.

Increased Enrollment in Chicago

ENROLLMENTS IN the Aeronautical University, Chicago, Ill., are now greater than at any time in the history of the school, and according to L. M. Charbuck indications are that this year will be the most successful that the school has yet experienced.

New equipment has been purchased, including four cutaway Wasps for instruction purposes, and three new instructors have been added to the faculty. Several engines are now in the shops for overhaul and repair. In addition a Boeing 40-C and a Challenger Commandaire are being used for instruction in rebuilding and repair work.

A new ship is nearing completion. This plane, designed by Bruce Smith, in charge of instruction and construction, is a two-place open cockpit full cantilever low-wing monoplane, representing the latest ideas in streamlining.

Montana School Has 25 Students

LIEUT. BOB Jellison of the Jellison Flying Service, Shelby, Mont., reports an enrollment of about 25 students in the flight and mechanics courses he conducts. Two ships, a Lambert Monocoupe and a Genet Barling, are used and approximately 100 hours a month are flown.

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AT THE AIRPORTS

Nicholls Heads Pacific Airmotive

PALMER NICHOLLS, who has been vice-president and general manager of Pacific Airmotive, Inc., since its inception, has assumed the presidency of the company following the death of W. E. "Tommy" Thomas. According to Nicholls, the company plans an expansion program.

Pacific Airmotive maintains headquarters at Union Air Terminal, Burbank, Calif., has a branch in Oakland, approved service stations in Seattle and San Diego and carries a stock of replacement parts of every make and type of airplane, besides being west coast distributors for Pratt & Whitney, Wright, Kinner, Continental, Lambert and Jacobs engines.

Engine Brokers Installs Sandblaster

NEW SANDBLASTING equipment and a bake oven are now being operated by Engine Brokers, Inc., Roosevelt Field, Garden City, N. Y., according to Donald B. Walling. The company also is equipped to install valve seats.

William Wieland, formerly with the firm, has sold his interest to Harry Hoddersen.

Longview Seeks Airport

THE AVIATION Committee of the Longview, Tex., Chamber of Commerce is considering the establishment of an adequate airport for the city, planning to build one which will be acceptable as an air mail terminal.

Fund for Beacon Being Raised

THE TYLER, Texas, Junior Chamber of Commerce is conducting a campaign to raise funds with which to erect a 24-inch, one million c.p. revolving beacon. The plan was inaugurated by William Fuller, manager of the local municipal airport, and it is contemplated locating the beacon on a 15-story building, providing the highest airway light between Red River and the Gulf of Mexico.

Repair Station Approval Granted

COMMERCIAL AIRCRAFT Co., of Swan Island, Seattle, Wash., has been awarded an approved repair base certificate by the Bureau of Air Commerce.

Equipment valued at $3,000 has been installed to meet the requirements of the Bureau and Vern St. John will be in charge of the shop.

Lambert Field Road To Be Built

A NEW and slightly shorter approach to Lambert-St. Louis Municipal Airport, St. Louis, Mo., will be constructed. The concrete road will connect up Natural Bridge Road, main thoroughfare to the airport, with the main drive on the southwest side of the airport. The money was appropriated by the city of St. Louis.

A crew of 50 men are now at work landscaping and improving the field.

NEW YORK CITY LEASES NORTH BEACH AIRPORT

GLENN CURTISS Airport at North Beach in Queens, has been leased for five years by the City of New York which has an option to purchase the 178-acre tract for $1,500,000 at the expiration of the lease. The airport will be used as a supplement to Floyd Bennett Field, the municipal project in Brooklyn, either as an airline terminal or as a base.

Runway Seeding Planned

RUNWAYS OF the La Crosse County, Wisc., airport will be ready for seeding in the spring, according to Raymond C. Bice, chairman of the county board's airport committee. There are two runways, one measuring 3,000 ft. and the other, 2,800 ft. Both are 250 ft. wide.

Hangar Site Donated

THE RUEL heirs have given an acre of ground at Raven Rock Airport, Portsmouth, Ohio, for the construction of a 100 × 125-foot hangar. A condition in the grant provides for the return of the property in the event it ceases to be used for hangar purposes.

Augusta Airport Progressing

RAPID PROGRESS is being made in the development, at Augusta, of Maine's finest airport, a state-municipal project, which when completed will include four hard-surfaced runways all more than 2,000 feet in length, and extensive facilities. It is located away from the coastal fog belt, above surrounding terrain, on naturally drained soil, and almost adjacent to the city.

Extensive clearing and grading has been finished; an 1,800 × 75-foot hard-gravel N-S runway laid down; NE-SW runway made serviceable, a small hangar built, and an 80 × 100-foot hangar with adjoining shop space, and a 40 × 60-foot, two-story administration building are under construction.

New Company Incorporated

THE TEXAS Fairchild Sales Corporation has been incorporated by R. E. McKaughan, M. E. McKaughan and J. D. Reed. The concern which will engage in plane sales, will be located in Houston.

Airlines Centralize At Love Field

EVERETT STUNTZ, Bowen Air Lines' traffic manager, has moved his company's offices into the Love Field, Dallas utilities corporation building. Braniff Airways has also completed arrangements to operate out of the same building, moving operating headquarters from Kansas City.

With Delta Air Lines and American Airlines already using space in the building, passengers for four of the five lines operating from Love Field board their planes at the same place.

Dallas Traffic Increasing

THE MONTHLY report of W. L. Williams, airport director of Dallas, Tex., shows that during October, 1934, passenger planes operating from Love Field carried more passengers than in any month since August, 1933.

Inbound planes transported 1,477 passengers, as compared with 1,243 in October, 1933, and 1,179 for October, 1932. Outbound planes carried 1,402 passengers in October, 1934, as compared with 1,266 for the same month in 1933. All planes operating at the field, including local short hop and transient planes, carried 3,081 passengers in October, 1934.

In addition, 49,000 spectators visited the field during the month.

Airport At Houlton, Maine, Under Way

IMMEDIATE DEVELOPMENT at Houlton, Me., of an airport of entry adjoining the New Brunswick border, is under way. Approval also has been given to a project at Auburn to serve the twin cities of Lewiston and Auburn.

Other Maine airport projects under the ERA are at August, Bangor, Bar Harbor, Brunswick, Caribou, East Millinocket, Jackman, Kennebunk, Pittsfield, Portland, Presque Isle, Sanford, Skowhegan and Waterville.

Meet Features Runway Opening

A PROGRAM of stunt and inverted flying featuring Art Davis, Lieut. Joe Mackey, Roger Don Rae and climaxed by a delayed parachute jump by Clem Sohn, officially dedicated the new hard-surface runways of the Transcontinental Airport, Toledo, Ohio. Another highlight of the dedicating ceremonies was a handicap Mystery Derby Race.

Each pilot was given a card having on it the location of an airport to which he was to fly to receive further directions. The course was around a 265-mile circuit with Lawerence Schidmilapp, flying a cabin Waco, taking first place. The director of the meet and race was Col. E. J. Burkhardt, assisted by Chet Fenton, manager of Transcontinental airport.

Barksdale Nears Completion

BARKSDALE FIELD, the new army field in Shreveport, home of the 20th Pursuit Group, is nearing completion, according to Capt. George E. Lamb, army constructing quartermaster. When finished it will entail a total outlay of $7,000,000, and as soon as it is ready, the Third Attack Group will be moved there from Fort Crockett. Nearly a thousand officers and men are stationed there now.

The field was built on a 22,000-acre tract, purchased by the city of Shreveport at a cost of $1,600,000 and given to the government. It is known as the largest government air reservation in the world, with a landing area 3½ miles long and a mile wide.

$278,248 Spent in Washington

DEVELOPMENT OF some thirty-two Washington airports under the ERA has resulted in expenditures of $278,248 in federal funds, with approximately $112,000 needed to complete work.

Eleven of the emergency airports have been completed; one at Davenport has been abandoned and a landing field at Harrington, on the northern transcontinental airway, substituted.

Hangar Nears Completion

WITH THE advent of winter in the region between Ashton and West Yellowstone, the Scenic Airways' route, company officials report the hangar in the airport bordering West Yellowstone, Idaho, nearing completion.

The hangar measures 60 × 60 × 36 feet and is on the corner of a 100-acre plot. The port affords citizens of West Yellowstone their only contact with the outside world which usually is cut off during the winter.

Hangar Opened During Show

FEATURING AN air show in which at least fifteen planes participated, a ceremony dedicating the new hangar at the Carbon County airport, Price, Utah, was held. Dean Brimhall, Utah director of the Federal airport program, was one of the speakers and an aviation ball concluded the program.

Army planes from Salt Lake City, under the command of Lieut. D. W. Goodrich, also participated in the dedication.

Spokane Operator Sells Out

MRS. P. M. BIGELOW, half-owner of the Bigelow-Johnson Aviation Co., Spokane, Wash., has sold her interest to C. A. Hartnett and H. L. Budd, owners of the other half interest. Mr. Budd is now president and Mr. Hartnett, vice-president, secretary and treasurer of the company.

Bigelow-Johnson was organized in 1928 by H. W. Johnson and the late Edgar Bigelow and represents an investment of about $20,000.

Clarktor tractor for airport work

Bloomsburg Field Progressing

WITH THE completion of a $10,000 administration building and repair shop and the addition of field acreage, the Bloomsburg, Pa., airport recently concluded a most ambitious program. Eight hundred feet were added to the airport and provision made in the new structure for administrative offices and a dope room or shop.

According to George S. Oberdorf, the airport is now the base for twelve planes, five of which are the property of the Bloomsburg Flying Club, the remainder belonging to residents in the immediate vicinity. Twenty-six active student pilots are enrolled in the flying school there.

During 1934, the field was designated an inspection point by the Department of Commerce and the repair base there was granted a repair station approval by the Bureau of Air Commerce. Other activities are conducted by Columbia Airways, which during the year flew 65,000 miles in conducting its business activities.

Bowen Takes Larger Quarters

BOWEN AIR LINES moved its Dallas headquarters at Love Field from Hangar No. 1 to the large hangar formerly occupied by United Air Lines when increased patronage over the line necessitated larger quarters. Bowen operates from Dallas to Tulsa, Oklahoma City and Chicago and between San Antonio, Houston and Austin with connections into Galveston, Brownsville and Mexico City.

Airways Work Almost Ready

CONSTRUCTION WORK is about completed on the lighted, radio-equipped airway route between Galveston and Waco, Texas. Intermediate landing fields have been provided at Hammond and Navasota. Texas airlines are now almost completely equipped with every known device for safe flying.

Ft. Wayne Hangar Rates Reduced

HANGAR STORAGE rates were reduced at the Paul Baer Municipal Airport, Ft. Wayne, Ind., in an effort to induce more private owners to rent space. The Board of Aviation Commissioners authorized a reduction of the monthly storage charge of $20, to $10, not including a 50-cent service fee whenever a plane is taken from the hangar.

Plans are also progressing for the construction of a restaurant building at the field and it is expected the project will be operating in the near future.

Easton Air Meet Held

SEVERAL THOUSAND spectators watched an air meet held at the Easton, Pa., airport recently, during which races and stunts featured the program.

The OX-5 race was won by Stanley Keck; Robert Gluee won the light plane race; and the free-for-all event went to F. Clemmons. A stunting contest was won by James Christman.

A double delayed parachute jump by G. J. Hand and Harry Dalrymple closed the show.

Ships from many nearby cities and states flew to the field for the events.

Large Fuel Tank Installed

A 25,000-GALLON fuel tank has been installed by the 154th Observation Squadron, Arkansas National Guard, Little Rock, for servicing planes of that unit and other army stations which stop there. The large tank was put in so that an ample supply of fuel might be maintained at all times. Little Rock is the only station in the state where Army ships may be serviced, except in emergency cases. An Aqua System water pressure pump is used.

Utica Airport Income $3,577

RECEIPTS OF the Utica, N. Y., municipal airport for the first eleven months of 1934 were less than $100 under those of last year, according to Superintendent Reginald Heath. Income amounted to $3,577.91 compared with $3,676.81 during the same period in 1933.

Lincoln Improvements Completed

WITH THE completion of further improvements at the Union Airport, Lincoln, Neb., the airport is one of the best equipped in that section of the state. Among the improvements is the installation of a double-end beacon, a row of lights around the entire field, a new wire fence and several floodlights.

Forest City Airport Dedicated

THE NEW municipal airport at Forest City, Ia., was recently dedicated with about 15 planes taking part in the dedication ceremonies.

AIRLINES and AIR TRAVEL

More Douglases in Service

REPLACEMENT OF Condor planes with 200-mile-an-hour Douglas transports on American Airlines' New York-Chicago day trips via Buffalo and Detroit went into effect December 2nd.

The fastest schedule of six daily trips brings Chicago within 4½ hours of New York, clipping 1 hour 19 minutes from the previous fastest flight. Making a single stop at Detroit, air travelers from the Automobile Capital will arrive at Newark, 2 hours 53 minutes after departure from Detroit.

Inauguration of Douglas service was not extended to the sleeper plane schedules which will continue as heretofore.

Day Condor planes, relieved by the new equipment will be placed in service on other lines, speeding up flying time by two hours between Boston and Cleveland via Springfield, Albany, Syracuse, Rochester and Buffalo. The last of the Ford transports operated by American Airlines has been retired.

Hawaiian Line Five Years Old

A TOTAL of 1,254,760 miles, 13,153 flying hours and 47,869 passengers has been recorded by Inter-Island Airways, which recently celebrated the fifth anniversary of its air transport service.

During these five years the company, using twin-engined Sikorsky amphibions, has maintained a daily (except Sunday) service connecting Honolulu with Hawaii, Maui, Kauai and other outlying Hawaiian islands.

Recently the company received an air mail contract to serve the main Hawaiian islands.

Express System Extended

AIR EXPRESS service was inaugurated to and from eleven New England cities served by Boston-Maine Airways and Central Vermont Airways, according to the Air Express Division of Railway Express Agency. One flight each way daily between Boston and Bangor, Me., and between Boston and Burlington, Vt., will be flown.

Signing of contracts between Railway Express and the two railroad-operated airlines marks another step in coordination of transportation facilities, providing not only through air express but also air-rail express service throughout the New England area.

EAL Reduces Chicago-Miami Time

HIGH-SPEED schedules, using Douglas transports, was inaugurated December 20 by Eastern Air Lines between Chicago and Miami for passengers, mail and express service.

Less than nine hours are required for the 1257-mile flight including stops at Louisville, Atlanta and Jacksonville. Regular schedules, previously in effect, will be continued with stops being made at Indianapolis, Nashville, Chattanooga and Macon, in addition to the above named cities.

TWA COMPLETES 99% OF NOVEMBER SCHEDULES

TWA, INC., maintained a 99.04% performance regularity during November, 1934, on its coast-to-coast service and between New York and Chicago. This performance is considerably higher than that of the same period last year, and was accomplished through the improvements and developments incorporated in the Douglas Airliner, making it feasible to fly over or around most weather disturbances.

Air Mail Schedules Increased

ADDITIONAL AIR mail schedules have been authorized by the Post Office Department on several routes, increasing the annual mileage flown over the domestic air mail system 3,083,520 miles, and making the total annual scheduled mileage 35,120,792.

These schedules include one additional round trip between Chicago and Kansas City, 405 miles (Braniff Airways, Inc.); Los Angeles and Fort Worth, 1,324 miles (American Airlines, Inc.); Chicago and New Orleans, 903 miles (Pacific Seaboard Air Lines); Fargo and Seattle 1,274 miles (Northwest Air Lines, Inc.); and St. Paul and Fargo, 226 miles (Hanford Air Lines).

A temporary extension of the Florida route from St. Petersburg to Daytona Beach and from Daytona Beach to Jacksonville, has been granted until the airport at Daytona Beach is put in condition for the New York-Miami planes.

In addition, air mail service will be established at Burlington, Iowa.

Faster Chicago-Washington Service

FOLLOWING PURCHASE of Boeing transports by Pennsylvania Airlines and Transport and inauguration of faster schedules on its Washington-Cleveland-Detroit route, schedules of approximately 4 hours 15 minutes, between Chicago and Washington were made effective by United Air Lines through connections with Pennsylvania's planes at Cleveland.

The placing of Boeings on the Washington-Cleveland route and also the Salt Lake City-Great Falls route of Alfred Frank Air Lines is expected to increase the flow of traffic on the main trunk line of United Air Lines with which Pennsylvania and Frank planes connect.

Airways Completion Expected

COMPLETION OF lights on airways between Tulsa, Okla., and St. Louis, connecting Tulsa with eastern and western important air terminals, is expected by February 1. Excavation stakes have been set for lights between Springfield and Tulsa and material delivered at five sites. Towers have been erected and beacons installed at three sites between St. Louis and Springfield. According to Charles Short, Jr., Tulsa airport manager, the work is being rushed and with the completion of lights, a night air mail and passenger schedule through Tulsa is planned. Lights already have been completed from Tulsa west to Los Angeles and from St. Louis east and north through Chicago and New York.

Traffic Department Reorganized

REORGANIZATION OF the traffic department of United Air Lines under the supervision of Harold Crary as director of public relations in charge of advertising, publicity and traffic, became effective last month following the resignation of K. A. Kennedy from the position of general traffic manager.

Under the new plan, traffic activities are being directed under the control of Crary by R. W. Ireland and B. B. Gragg. Ireland was formerly assistant to the general traffic manager and Gragg was district traffic manager at Cleveland.

Other current changes in the company include the appointment of Paul Wright as assistant to W. A. Patterson, president and Buck Weaver as assistant to the maintenance superintendent at Chicago.

1934 Traffic to Show Increase

AN APPROXIMATE fifteen per cent increase in passenger traffic over 1933 was forecast for 1934 by United Air Lines officials when a check of the first ten months showed a total of 127,237 revenue passengers, 17 per cent more than the 108,713 passengers carried in the same period in 1933 and approximately equivalent to the 1933 total of 127,693 revenue passengers.

Air express shipments will show an increase of about 140 per cent over the previous year's volume, as 444 tons of express were carried during the ten-month period as against 181 tons in the same period of 1933.

Frye Elected TWA President

THE ELECTION of Jack Frye to the presidency of TWA, Inc., was announced by company officials on December 6, 1934.

Frye, who only recently was named vice-president and general manager of the company, will continue in active charge of flying operations.

Airways Route Nears Completion

WORK OF lighting and equipping the northern transcontinental airway for which the Department of Commerce is spending $655,000 is progressing rapidly. Beacon lights between the Twin Cities and Bismarck are already operating and construction work west from Bismarck is being rapidly completed. According to present plans, beacon lights between Bismarck and Dickinson will be operating first, then between Dickinson and Miles City, while beacon lights will also be operating in the near future between Spokane and Seattle.

The northern transcontinental, the shortest route to Seattle, Alaska and the Orient has beacon lights every ten to fifteen miles, intermediate fields every 50 miles and directional radio range beacons every 50 miles.

New Express Rates Bring Increase

A 20-PERCENT gain in air express was made on United Air Lines as a result of the reduction of express tariffs on all lines in the United States. Officials of the company reported a prompt increase following the lowering of rates, and statistics provided by the Air Express Division of the Railway Express Agency indicated a gain in both volume and revenue of express sent by plane.

Rose Moves To Oakland

J. A. ROSE, who has been stationed in Sacramento for several years as traffic representative of the United Air Lines, has been transferred to Oakland, where he will continue to be in charge of the Sacramento, Oakland and Reno territory.

Al Everett of Oklahoma has assumed new duties at Sacramento as the operations manager.

Airmail Service Progresses

THE RECENTLY installed air mail service at Idaho Falls has created a favorable reaction on flying, according to E. Y. Wells, traffic manager of Alfred Frank airline. An average of 11 pounds of mail per day has been sent out from the local postoffice during the past month via the two planes that stop daily and deliver and pick up mail at the newly completed airport there.

Varney Moves Headquarters

VARNEY SPEED Lines, Southwestern Division, operating between El Paso, Texas and Pueblo, Colorado, have moved their headquarters, operations and mechanical personnel from the latter city to El Paso.

Varney is operating a daily schedule between the two cities with stops at Albuquerque, Santa Fe and Las Vegas, New Mexico, providing a link between the northern points and El Paso, and giving connections with transcontinental lines and Central Airways of Mexico, operating between El Paso and Mexico City. Passengers, mail and express are carried.

Avery Black is general manager of the line, with Jess Hart as chief pilot.

UNITED HAS FOUR-MONTH PERFORMANCE RECORD

UNITED AIR Lines completed 98½ per cent of the total mileage scheduled during a recent four-month period, during which time more than a million miles were flown monthly. Approximately forty per cent of the mileage was flown at night.

Hanford Starts Two More Lines

HANFORD TRI State Airlines, Sioux City, Iowa, contract holder for air mail service between Chicago and St. Paul-Minneapolis and Fargo and Pembina, N. D., inaugurated air mail and passenger service between Minneapolis, Omaha and Kansas City and between Sioux Falls, S. D., and Bismarck, N. D. The new lines carry passengers, baggage and express in addition to mail. Tri-motored Stinsons are being operated on the Omaha-Kansas City run and Lockheed Vegas on the other routes.

Through connections at Omaha with United Air Lines planes, this new service provides a 13½-hour mail and passenger schedule from the Twin Cities to San Francisco and a 14¾-hour schedule to Los Angeles.

Maroney Shifted To Seattle

E. J. MARONEY, for several years manager of United Air Lines field at Rock Springs, Wyo., has been appointed field manager for that company at Seattle, Washington. Ray Aho, also employed at the Rock Springs field, is scheduled to succeed Maroney there. Both Maroney and Aho entered the Boeing service as mechanics, advancing steadily to earn their present position, the latter being assistant field manager prior to his advancement.

Delta Carrying Passengers

PASSENGER SERVICE between Dallas and Charleston, S. C., has been resumed by Delta Airlines, Inc., holder of the mail contract along this route. Connections may be made at Dallas and Charleston for planes east, north and west over Eastern Airlines, American Airways, Bowen Airlines and Braniff Airways.

New low fares have been put into effect, the rates being as low as, or lower than, those charged by other operators.

Bowen Improves Service

BOWEN AIRLINES is now operating a double daily service between Dallas and Houston, Tex., and has extended its Dallas-San Antonio line to Brownsville for connection with Pan American Airways to and from Mexico and South America. The Brownsville schedule calls for a 3 p.m. departure from Dallas with arrival at Brownsville at 7:10 p.m. The return ship leaves Brownsville at 1:15 p.m. and arrives at Dallas at 5:45 p.m. Planes for Houston leave Dallas at 8:30 a.m., and 3 p.m., and returning at 10:30 a.m. and 5 p.m., with a 100-minute service scheduled.

Private Ticket Offices Provided

THE CONSOLIDATED Airlines Ticket service in the Oklahoma City municipal air terminal was divided into two offices. Extensive remodeling which followed the dissolution provided individual ticket offices for American Airlines and Braniff Airways, Inc. The change also moved the American Airlines radio station to adjoin its new ticket office on the ground floor. The American ticket office will be manned by its regular radio crew, according to M. E. Wilkerson, traffic manager. Warren Moseley, former head of the Consolidated office, will be in charge of the Braniff office.

New Routes to Be Lighted

INSTALLATION OF lighting equipment on the St. Louis-Tulsa-Dallas and the St. Louis-New Orleans air mail routes will be completed about Jan. 1, and St. Louis will have the necessary facilities for overnight air mail service to the South and the Southwest. E. Y. Mitchell, Assistant Secretary of Commerce, has advised the local Chamber of Commerce that the Post Office Department had given assurance overnight mail service would be inaugurated as soon as the lights were installed.

The final beacon sites on the St. Louis-Tulsa route have already been selected and lighting of the New Orleans-Jackson section of the St. Louis-New Orleans route is almost completed.

Schedule Increase Planned

BEGINNING ABOUT February 1, Northwest Airlines plans to double its service between Seattle and Chicago, with two planes each way daily. A new lighting system from Seattle to Fargo, expected to be completed the first of the year, will help augment operations.

United Flies to Mexico

AGUA CALIENTE, Mex., resort city directly south of San Diego, was added to the Pacific coast route of United Air Lines in December to make that line a three-flag airway from Vancouver, N. B., to the Mexican point. The airway is 1,385 miles long.

PRIVATE FLYING and CLUB NEWS

College Clubs Adopt Flight Program

REPRESENTATIVES OF the nation's leading college flying clubs at a recent conference in Washington decided on a 4-point program which is expected to stimulate aviation flight training among undergraduates.

The program calls for an annual intercollegiate aviation meet; inauguration of an annual national college flying conference; formation of an undergraduate committee to work in cooperation with the NAA in stimulating college aviation activity; and formation of a national organization committee to apply for a charter for a National Intercollegiate Flying Clubs Chapter. Points won in the annual meet are to count toward award of the Loening Intercollegiate Flying Club Trophy.

Events approved for the first intercollegiate air meet included bomb dropping, dead stick landing, precision flying and paper strafing contests. No high speed closed course races will be flown.

Flying clubs represented came from the University of Minnesota, William and Mary, Amherst, Yale, the University of Detroit and New York University.

Miller Heads Ft. Wayne Group

EARL J. MILLER, secretary of the Municipal Airport at Fort Wayne, Indiana, was elected president of the Fort Wayne Aero Club at the annual election of officers. Other officers chosen included Amby Babbitt, vice-president; Kathryn Denney, secretary; Arthur H. Floering, treasurer; Capt. Clarence F. Cornish, Eugene Campbell, Bernard Lloyd and Robert T. Schott, members of the advisory board.

Legion Uses Plane to Collect Cards

THE AMERICAN Legion has taken to the air in an effort to speed up collection of membership cards. An airplane piloted by J. D. Sellers flew to Hattiesburg and other points in South Mississippi bearing officials of the Mississippi American Legion to collect cards which had been collected by the various Posts in the territory covered. The ship landed at the Municipal Airport in Hattiesburg where it was met by Nathan Fairchild and others representing the American Legion Post. The cards were handed to the pilot and the ship then took off for other posts in that section. This method of collecting membership cards was reported as very successful and will probably be continued each year. Heretofore, each Post sent its cards as they were collected, causing a great deal of delay.

MINNESOTA CLUB WINS 1934 LOENING TROPHY

THE LOENING Trophy for 1933-34 was won by the University of Minnesota Flying Club, whose undergraduate pilots flew a total of 425 hours during the school year. This marks the first time a midwestern flying club has won the competition which was established in 1928 by Grover Loening. William and Mary Flight Club was second; Dartmouth and Harvard received honorary mention.

Glider Demonstrations Given

DEMONSTRATIONS IN advanced and primary gliders were given by 10 members of the South Bend, Ind., Glider Club at the municipal airport in that city recently in the first of a series of exhibitions to be given by the club. One of the Franklin gliders, flown by Clyde Brower and Guy Weber, attained 1,200 feet during the flights. Primary glider work was done by a number of members. Homer Stockert of the Stockert Flying Service is government observer for the club, with authority to conduct examinations of glider students, and issue licenses.

Department Store Forms Club

THE MAISON-BLANCHE of New Orleans, one of the largest department stores in the South, has organized an aviation club, and stages regular meetings in the auditorium of the store. Recent meetings have featured nationally-known aviation men including R. K. McWilliams of the Department of Commerce, and B. A. Armstrong, professor of aeronautics at the Delgado Trades School, New Orleans. Wedell-Williams Air Service recently gave two free plane rides for compositions on aviation. The club is operated free of charge for young men in the city of New Orleans.

Twenty-five Events at Miami Races

THREE DAYS of competitive flying, in addition to a number of social affairs, are featuring the Seventh Annual All-American Air Races which are to be held at the Miami, Fla., municipal airport January 10-12, inclusive. Cash prizes totalling at least $5,500 and numerous trophies are to be awarded.

The races are being held under the auspices of the Greater Miami Airport Association, are sanctioned by the NAA and are to be conducted under FAI rules.

Thirteen speed events, three bomb dropping and three dead stick landing contests are on the program. In addition, there will be men and women's aerobatic contests and parachute jumps.

Blind Flying Taught Commercially

A COURSE of instruction will be given in blind flying for commercial air pilots at Patterson Field, Dayton, Ohio. The decision to furnish such instruction follows closely on the Army Air Corps' action to provide similar instruction for its pilots.

The system, devised and perfected by Capt. A. F. Hegenberger of Wright Field, is the same as that employed by the army flyers. It makes particular use of the radio compass and other instruments, enabling pilots to land without seeing the ground.

Committee to Boost State Aviation

CHARLES M. TAYLOR, Arkansas airport supervisor; Capt. C. W. Holderbaum, airport engineer; Cecil E. West, station manager for American Airlines; Felix Smart, state NAA president and Fred Rix, have been named members of a joint Arkansas aviation coordinating committee for the promotion of civil aeronautics. The committee has an active program for the state and is contacting Congressmen and business leaders in regard to an aviation legislative plan.

SAE Features Aviation Speakers

THE DECEMBER meeting of the metropolitan section of the Society of Automotive Engineers in New York City featured talks by T. Park Hay of TWA; F. W. Caldwell of Hamilton Standard; Stephen Zand, Sperry Gyroscope Co., R. F. Gagg and Casey Jones.

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THE AIR SERVICES

Army Planes at Miami Races

ARMY ATTACK and pursuit planes from three fields will participate in the All-American Air Races which are to be held this month from the tenth to the twelfth at Miami, Fla.

About forty planes will gather at the field to engage in tactical training exercises during the races. Twenty-three are from the First Pursuit Group, Selfridge Field; fifteen are from the Third Attack Group, Fort Crockett and three are from Maxwell Field. Boeing P-26A's, a Consolidated P-30 and other types are flown by these groups.

The demonstration of these units has been made possible by the fact that the Winter field maneuvers of the Second Bombardment Wing from Langley Field will be in the immediate vicinity of Miami. Also at that time, the observation squadron from Mitchel Field, New York, utilizing Curtiss O-39's, will be undergoing gunnery training at Chapman Field, near Miami.

Aviation Training for Midshipmen

UNDER A plan now being studied by the Navy Department, every candidate for the Naval Academy, Annapolis, would be required to qualify physically for training in aviation and be taught to fly during his midshipman training.

This preliminary aviation instruction would be augmented by additional flight training after graduation, but the officers would have diversified duty assignments, rotating between sea and air details.

The plan to require every Midshipman to be physically fit to fly, will, it is felt, solve a number of problems which have arisen since aviation become an important part of the Navy.

Stratosphere Fliers Honored

MAJOR WILLIAM E. Kepner and Captain Albert W. Stevens of the U. S. Army Air Corps received the Distinguished Flying Cross from the War Department for their participation in the stratosphere flight from Rapid City, S. D., on July 28.

CORRY FIELD, PENSACOLA DEDICATED BY KING

MARKING THE completion of a $1,000,000 program extending over two years, Corry Field, the new U. S. Navy plane and glider training base six miles from the main station at Pensacola, Fla., was dedicated on December 8 by Rear Admiral Ernest J. King, Chief of the Bureau of Aeronautics, U. S. Navy.

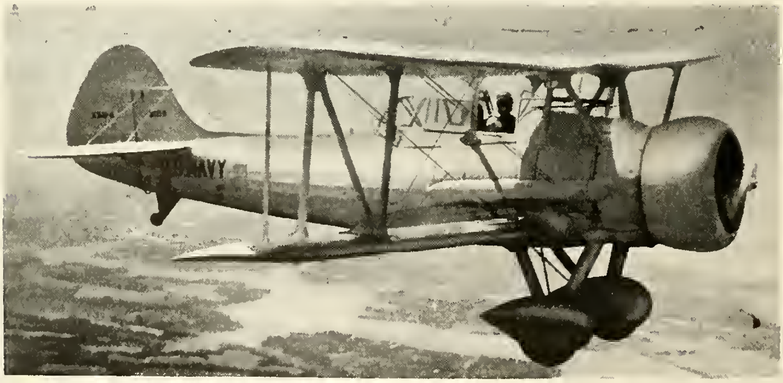
Reserve's Equipment Overhauled

ONE OF the 154th Observation Squadron, Arkansas National Guard's Douglas O-38 planes has been returned from the Fairfield Air Depot, Dayton, O., where it was completely overhauled. Capt. Charles Horn, regular army instructor assigned to the unit, ferried the ship to the base at Little Rock. Another plane of the unit is at the depot being rebuilt now while two others are awaiting orders to be sent in for an overhaul. New engines recently have been placed in two of the ships.

Hensley Field Improvement Planned

INDORSED BY Capt. Bernard S. Thompson, commandant of Hensley Field, Dallas, Tex., a plan to provide bus service to the base is being actively pushed. During 1934 a greater number of Army planes landed at Hensley Field than in 1933 when more than 2,000 ships used the facilities there.

The field is being beautified by flowers and shrubs and two additional crushed rock runways are now under construction.



New-type scouting plane, Vought SU-4, powered by a P. & W. twin-row radial engine

Army Buys 231 Planes

INITIAL STEPS to build up the U. S. Army Air Corps to a position second to none, were taken by the War Department when it purchased 110 attack, 50 pursuit and 71 observation planes.

The order for the attack planes was the largest for military aircraft in several years and went to the Northrop Corporation of Inglewood, Calif., under a contract price of $1,896,400. Consolidated Aircraft Corp., Buffalo, N. Y., sold the Government the pursuit planes for $1,996,700, and Douglas Aircraft Co., Santa Monica, Calif., sold the observation planes for $1,655,394, making a total outlay of $5,551,494, less engines.

The Consolidated pursuit planes are capable of a top speed of at least 252 miles an hour and carry two persons. They raise the speed of our pursuit planes almost 100 miles an hour and about 50 miles an hour over the fastest single-seater now in service.

The Northrop attack planes are low-wing, all-metal jobs capable of a speed of at least 215 miles an hour, an advance of about 40 miles an hour since the last attack planes were bought.

Power plants for these types have not yet been announced, but the experimental Northrop planes had a P. & W. Hornet and Twin-row engine.

These contracts bring to 312 the number of new planes ordered in recent months. Thus far 81 bombers, in addition to the planes contracted for in this order, were purchased and about a score more will be bought soon to obligate all of the current year's appropriations. Delivery of all three types will be started soon after June 1, so that a steady replacement program will be carried on until next year's funds become available.

Pensacola Flight Class Convenes

THIRTY-FIVE officers from the Navy, Marines and Coast Guard units are now taking flight training at the Pensacola, Fla., Naval Air Station.

Sixteen members of this class had experimental glider training, completing their course before entering flight training. Each made 150 or more glider flights, the work being unmarred by any casualty to personnel and slight damage to one glider.

Naval Reserve Base Improved

AN EXTENSION to the brick building of the United States Naval Reserve aviation base, St. Louis, Mo., will be built from a $14,000 appropriation supplied by a St. Louis municipal bond issue. The base now has facilities for nine planes. Lieut. Frank Welds is division commander.

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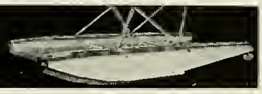

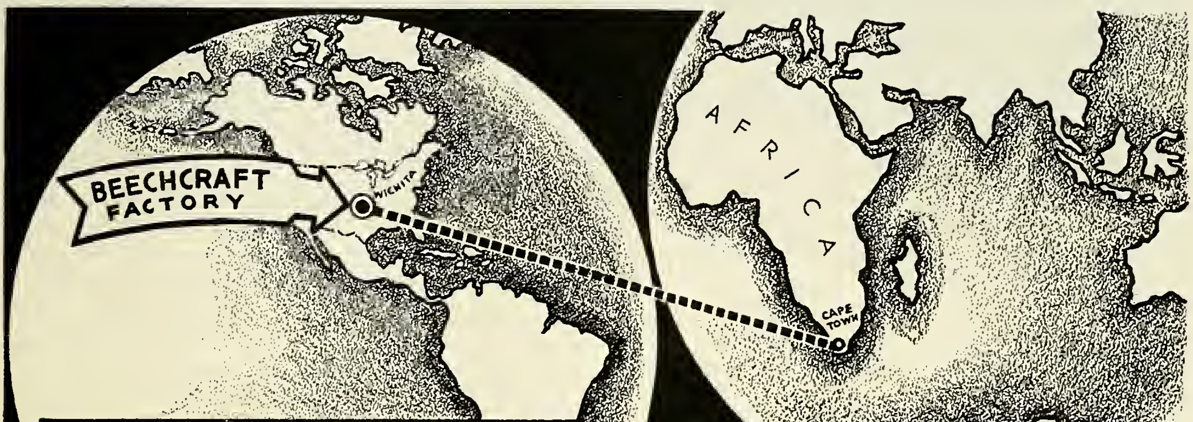

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THE INDUSTRY IN GENERAL

Boeing Reviews 1934 Progress

DEVELOPMENT OF faster and more comfortable commercial air transport equipment and continued progress in providing planes for the military services featured activities of the Boeing Aircraft Company of Seattle, in 1934.

Late in the year, the company completed its project involving seventy-five Model 247 and 247-D transports, valued at approximately $5,000,000, for United Air Lines and other transport operators.

Ten of the Model 247-D's have gone to United Air Lines. They are equipped with two geared 550 horsepower supercharged P. & W. Wasp engines and three-bladed Hamilton Standard controllable-pitch propellers, have a top speed of 200 miles an hour and can climb to 11,500 feet on one engine.

In addition to its transport project, the Boeing company last year delivered a fleet of all-metal, single-seater, Wasp-powered P-26A pursuit planes to the Army Air Corps. While performance figures for the fighters have not been released, they are ranked as the world's fastest air-cooled pursuits.

The company now is a unit of an independent western manufacturing organization known as the Boeing Airplane Company. Other units are Stearman Aircraft Co., Wichita, Kans., and Boeing Aircraft of Canada, Vancouver, B. C.

775 Planes Are Radio-Equipped

THERE ARE 775 radio-equipped airplanes in commercial and private operation in the United States according to the Bureau of Air Commerce, Department of Commerce.

Scheduled airlines lead in number of radio-equipped aircraft with 345; miscellaneous commercial operators, such as charter and taxi services, have 49 and business firms operating airplanes have 135 which are radio-equipped. Private owners with radio in their airplanes number 246.

Army, Navy, Bureau of Air Commerce, other Federal agencies or state government aircraft are not included in the study.

The 775 radio installations include 326 which are two-way, the others being receivers only.

The radio-equipped airplanes are distributed among nearly all of the 48 states. In addition, there are three radio-equipped airplanes of American registry in Alaska and four in Hawaii.

CHINA BUYS FIFTY CONSOLIDATED TRAINERS

CONSOLIDATED Aircraft Corp., Buffalo, N. Y., has announced the receipt of an order from the Chinese Government for 50 training planes costing $243,000. Thirty of the planes will be assembled in Buffalo while the remaining 20 will be sent to Shanghai, where they will be assembled at a new army base there.

October Exports Reach $1,619,790

AMERICAN AERONAUTICAL exports continued to exceed the million dollar per month mark when October, 1934 sales to foreign purchasers reached $1,619,790. The greater part, $724,759 was for 50 airplanes while $645,084 was for parts and accessories. Sales of aircraft engines amounted to $225,800 for 61 units and parachutes brought $24,147.

Soviet Russia was our best customer in October spending a total of $424,422 for engines, parts and accessories. Mexican purchasers took seven planes valued at $220,700 and Brazil bought $10,620 worth of parachutes.

Turkey imported the greatest number of aircraft for the month, 12. Other purchasers of aircraft were from Rumania (8), Portugal (5), China (3), Hongkong, Spain, United Kingdom and Canada, two each and Austria, Honduras, Argentina, Brazil, Colombia and Japan, one each.

Two Airlines Buy Boeings

BOEING TRANSPORT planes have been purchased by Alfred Frank Air Lines and Pennsylvania Airlines and Transport Corp. As a result, both will offer faster and more luxurious service over their respective routes. Pennsylvania will operate the Boeings between Detroit and Washington, via Cleveland, Akron and Pittsburgh, while Frank will fly them between Salt Lake, Utah, and Great Falls, Montana.

Post Heads New Company

WILEY POST has been named head of the Wiley Post Aircraft Corp., a commercial airplane manufacturing company which, according to reports, will operate at the Curtiss-Wright airport near Oklahoma City. The $100,000 airplane manufacturing corporation it is said, temporarily will use the design and materials recently purchased by Mark Kleedon from the Straughan Aircraft Co.

All planes turned out will bear Post's name, and licenses for two were recently granted. Constructed under the direction of John Burke, the planes will be used for company business and none will be offered for sale until ten have been produced, Kleedon announced.

The concern has been chartered as a closed corporation and besides Post, other officers are Kleedon, vice-president and T. J. Ruddy, secretary-treasurer.

EAL Buys Western Electric Sets

THE LATEST air transport line to adopt Western Electric radiophone as standard equipment is Eastern Air Lines, which has equipped its five Douglas *Florida Flyers,* recently put into service on the Miami route, with short wave receivers, transmitters and beacon receivers. Four more Douglas planes soon to be put in service by this line are being similarly equipped.

Radio ground stations of Eastern Air Lines are being adapted to operate with this equipment in the planes by the installation of special crystal units for the control of frequencies.

Six Beechcraft Sold

BEECH AIRCRAFT Co., Wichita, Kan., has sold three Beechcrafts powered with the 225 h.p., Jacobs engine to The Beech-Air Sales Company, Glenn Curtiss Airport, Jackson Heights, Long Island, New York. In addition, a Jacobs-powered Beechcraft was exported to Rogers-Jenkins Co. (Pty.) Ltd., Johannesburg, South Africa. This Beechcraft will be turned over to Otto Thanning, Consul-General from Denmark.

Other Jacobs-powered Beechcraft were delivered to the Olson Drilling Co., Tulsa, Okla., and to Frederick G. Francis, Kirkside Station, St. Augustine, Fla.

(*Continued on following page*)

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☐ Send me additional data regarding Karsmetik dealership.

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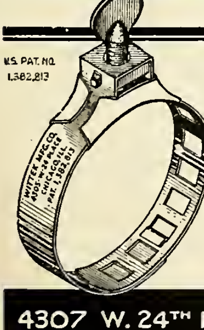
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Regular Pilot Albert Ball (United Air Lines) gives his views of training schools

"Since I graduated from Boeing—"

"I've seen too many men with a pretty diploma trying to land jobs that required a background they just didn't have," wrote Albert Ball to a younger friend recently. "My advice to you is choose a conservative school like Boeing—where, besides flying, they give you plenty of hours of 'practical' and 'theoretical'."

We reproduce this comment because it expresses so aptly the viewpoints of United Air Lines and of Boeing School itself. Any Boeing graduate will agree that the courses here are much more comprehensive than those usually offered.

For example, the Boeing Airline Pilot and Operations course comprises 4015 hours of solid work. Lecture and shop, apprentice work, airline operations, dual and solo flying in 11 different types of planes . . . a concentration of experience few men in the industry get even from a lifetime of practical work.

If you are willing to grind in order to attain a worthwhile career in aviation, write today for further information about Boeing School and enrollment requirements. Rates from $700.00 upwards; courses from nine months to two years. Mail coupon today.

Boeing School of Aeronautics
Division of United Air Lines

"How to decide on your Aviation School"

W. D. Williams, Pilot Midwest Division, United Air Lines, lists 7 vital points to investigate:

- Has it a "playboy flying school" reputation — or is it known for its hard work?
- What equipment will I *actually* work with — in planes, laboratories, shops?
- Who are the men I will *actually* study under?
- Has school advantage of direct association with a large airline?
- What are its graduates doing?
- How does the U. S. Govt. rate it?
- Are students lured by promises of jobs; or are they attracted by the school's superior training?

NEXT REGULAR ENROLLMENT APRIL 1

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Gentlemen: I am interested in the courses indicated:
☐ Boeing Airline Pilot
☐ Transport Pilot
☐ Limited Com'l Pilot
☐ Private Pilot
☐ Airline Mechanic
☐ Airline Operations
☐ Airline Technician (Open to Engineering graduates)
☐ Airline Pilot and Operations
☐ Special Airline Pilot (For Transport Pilots only)
☐ Amateur Pilot

Name ____________________ Age ________

Years in High School ____________ Years in College ____________

Address ____________ Phone ____________

City ____________ State ____________

(Continued from preceding page)

Pan American Orders More Planes

FOUR FLYING boats, similar to, but larger and faster than the Sikorsky S-42, have been ordered from the Sikorsky Aircraft Corp., Bridgeport, Conn., by Pan American Airways, according to Juan T. Trippe, airline president.

Mr. Trippe said the new order, which will cost more than $1,000,000, will give his company a fleet of ten long-range planes adaptable for over-water flying and a total aircraft complement of 125. This fleet will consist of seven Sikorsky and three Martin craft with trans-oceanic flight possibilities.

The four ships ordered are known as S-42-B's and will be different from the present S-42's in that they will have more powerful P. & W. Hornet engines, Hamilton Standard automatic constant pitch propellers and trailing edge flaps extending the full length of the wing. Their estimated non-stop range is 3,000 miles at 165 m.p.h. cruising speed, with 10 or 12 passengers and 2,000 lbs. of mail and express.

Schaefer Heads Stearman

OFFICERS OF the Stearman Aircraft Co., of Wichita, Kan., a unit of the Boeing Airplane Co., have just been announced as J. E. Schaefer, president; Mac Short, vice-president in charge of engineering, and Cliff Barron, secretary and treasurer. Members of the board include, besides the officers, H. F. Brown, in charge of manufacturing, and George Seifkin, company attorney.

The company now is engaged in turning out forty-one two-seater primary training planes for the Navy.

Two Added to United Board

FOLLOWING A meeting of the Board of Directors of the United Aircraft Corp., announcement was made of the election to the board of Peter M. Fraser, vice-president of the Connecticut Mutual Life Insurance Company of Hartford, and of Thomas F. Hamilton, European representative of the United Aircraft Exports Corp.

In addition to Mr. Fraser and Mr. Hamilton, the present Board of Directors of United Aircraft consists of F. B. Rentschler, D. L. Brown, George S. Wheat, E. E. Wilson, J. F. McCarthy, C. W. Deeds, James G. Scarff, F. William Zelcer, Malcolm Sumner, E. O. McDonnell, and W. B. Mayo. Donald L. Brown is president of the corporation and Mr. Wheat and Mr. Wilson, vice-presidents.

(Continued on following page)

• Digest of Recent Events •

French Cross Ocean In New Flying Boat

MAKING HER maiden flight, the giant French seaplane, *Santo Dumont* successfully negotiated a non-stop trip from Dakar, French West Africa, to Natal, Brazil, carrying mail. NOV. 28

Post Fails to Set New Altitude Mark

ALTHOUGH Wiley Post believed he set a new world's altitude record when he made his second flight from Bartlesville, Okla., into the stratosphere in his Lockheed *Winnie Mae*, the Bureau of Standards in Washington reported that his barograph indicated he had not exceeded by 200 meters the present record of 47,352 feet. Post was encased in his rubber suit and remained aloft 2 hours 26 minutes, landing at Phillips Airport. DEC. 8

Douglas Climbs to 29,800 Feet in Peru

THE WORLD'S altitude record for standard commercial passenger planes was believed to have been broken when E. T. Allen, flying the Pan American Grace Airways Douglas transport *Santa Lucia*, attained a height of 29,800 feet near Lima, Peru. Allen was accompanied by Prof. Sergei Koroff of the California Institute of Technology. DEC. 10

England-Australia Mail Service Starts

AS HIS last official act in Australia, the Duke of Gloucester sent off the first mail plane to England, thus inaugurating a long-awaited service which links England and Australia with air facilities. The mail is to be dispatched weekly and a schedule of 14 days will be maintained between Melbourne and London. It is understood, however, that this time will be cut to seven or eight days in the near future. The itinerary includes 5,277 miles of flying in the collection and distribution of mail in Australia alone. DEC. 10

KLM Pilots Fly Atlantic to Curacao

THE INITIAL flight from The Netherlands to Curacao in the Dutch West Indies 6,500 miles away over 2,300 miles of the Atlantic got underway at the airport in Amsterdam when KLM's chief pilot, J. J. Sondong, a crew of four and a large load of mail took off in a Fokker F-18 powered by three P. & W. Wasp engines. Eight additional fuel tanks were in the plane, giving enough capacity for 1,450 gallons, providing ample margin for the ocean hop. DEC. 15

Coast Guardsman Sets Amphibion Speed Record

LIEUT. COMDR. E. F. Stone of the U. S. Coast Guard flew a Grumman amphibion powered by a Wright Cyclone engine over a course at Grand View on Chesapeake Bay at an average speed of 191.796 miles an hour, to set a new world's record for that type of plane. The best time made during the flight was 196.89 miles an hour. The former record was 177 miles an hour. DEC. 20

Rickenbacker Cuts Chicago-Miami Time

COMPLETION OF the return trip of a round-trip flight between Chicago and Miami saw the two cities brought within 7 hours 40 minutes of each other in an Eastern Air Lines' Douglas transport commanded by Capt. Eddie Rickenbacker. The flight cut 2 hours from the last commercial mark set by one of the company's mail planes two months previously. DEC. 20

Delmotte Flies to Landplane Speed Mark

JIMMY WEDELL'S landplane speed record was broken by Raymond Delmotte who flew his Caudron Renault over a closed course at Istres, France, at an average of 314 miles per hour. DEC. 25

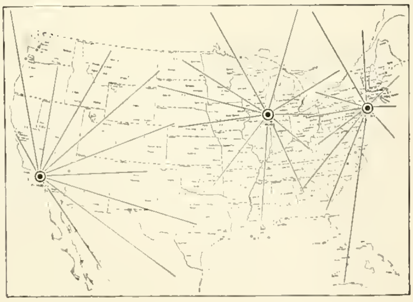
• Coming Events •

Miami Races

Seventh Annual All-American Air Races, Miami Municipal Airport, Miami, Fla. JAN. 10-12

Boeing Competition

Entries for Sixth Annual Wm. E. Boeing Scholarships close. Boeing School of Aeronautics, Oakland, Calif. MAR. 15



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(Continued from preceding page)

Mechanics Exam Scheduled

THE U. S. Civil Service Commission has announced an open competitive examination for Master Mechanic, Aircraft Engine Manufacture.

Applications for the position at the Naval Aircraft Factory, Philadelphia, Pa., must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than January 5, 1935.

The rate of pay ranges from $11.04 to $17.04 a day, subject to a deduction of not to exceed 5 per cent during the fiscal year ending June 30, 1935, as a measure of economy, and also to a deduction of 3½ per cent toward a retirement annuity. Certain specified experience is required.

Full information may be obtained from the Secretary of the United States Civil Service Board of Examiners at the post office or customhouse in any city which has a post office of the first or the second class, or from the United States Civil Service Commission, Washington, D. C.

Float-Equipped Airster Approved

AN APPROVED type certificate has been granted the Security National Aircraft Corp., Van Nuys, Calif., on its new pontoon equipped Security Airster, according to W. B. Kinner, president.

The new seaplane model, equipped with Edo model 1835 floats, retains all features of the Airster landplane including the patented folding wing. It is powered with a 100-horsepower Kinner engine.

The first seaplane off the production line has been shipped to R. Hesselberg-Meyer A/S of Oslo, Norway, exclusive Security Aircraft sales agent for the Scandinavian countries.

Float-equipped Kinner-powered Airster

In flying the Airster to College Point, Long Island where the floats were installed, Mr. Kinner covered the 2600 miles from Los Angeles in 30 hours, using only 165 gallons of gasoline; his average speed was 86.66 m.p.h., giving 15 miles per gallon.

HALL-ALUMINUM MOVES TO BRISTOL

OFFICES AND factory of the Hall-Aluminum Aircraft Corp., have been moved from Buffalo, N. Y. to Radcliffe Street, Bristol, Pa., where the company will continue production and experimental work on flying boats for the U. S. Navy.

Revision of Air Laws Planned

PROPOSED CHANGES in the Wisconsin aviation law were agreed upon at a conference between Milwaukee county aviators and C. Stanley Perry, assistant county corporation counsel. The conference recommended that the law be changed to compel commercial planes to carry insurance to protect passengers and cargoes, and property and lives on land.

Clarification of the state law to permit airworthy planes to carry passengers after state inspection, was recommended. A federal license is now required. Another recommendation was that the state issue certificates to aviation instructors. The federal government now licenses aviation schools but the fees of such schools in some cases were felt to be too high.

Fairchild Appoints Distributor

AVIATION COUNTRY Club, Palwaukee Airport, Mt. Prospect, Illinois, a Chicago suburb, has been appointed distributor for Fairchild airplanes in that area. A demonstrator is being flown by Clifford Condit, club manager. Deliveries of three new Fairchild cabin 24's and an open 22 have been made to members of the club.

Nabell Named Ryan Superintendent

T. CLAUDE RYAN, president of the Ryan Aeronautical Co., San Diego, Calif., has announced the appointment of E. G. Nabell as factory superintendent. At the time of his appointment to his present position by the Ryan Company, Nabell was in the production department of a major aircraft factory in California.

Bellanca Improving Skyrocket

WHILE ITS sales department is concentrating on securing orders and its engineering department is refining and improving the Senior Skyrocket, Bellanca Aircraft Corp., New Castle, Del., announces that the plane will conform to the latest design requirements of the Department of Commerce, will feature a more sturdy tail group, all-metal lift struts and wing flaps, sturdy and more graceful cantilever landing gear, and larger cabin dimensions.

At least two have already been sold; one went to Frank W. Fuller, Jr., of Roosevelt Field, Long Island, N. Y., and the other was purchased by Wallace Beery, the actor.

In addition, the company has completed an order for four seaplane bombers (described in the October issue of AERO DIGEST) for Colombia.

Jap Paper Buys Stinson Reliant

ONE OF the leading newspapers of the Orient, *Shimba Sha,* has purchased a Stinson Reliant monoplane, Lycoming powered, for use in covering news stories in Japan. The airplane was ferried from the factory to Grand Central Air Terminal, Glendale, Calif., where it was dismantled and crated for trans-Pacific shipment.

It is understood that the cabin would be rebuilt into a portable photographic laboratory for use of news cameramen.

Ryan Distributorship Awarded

DISTRIBUTORSHIP FOR the new Ryan S-T low-wing monoplane in the New York area has been awared to John H. von Eyssenhardt, according to Earl D. Prudden, vice-president of the Ryan Aeronautical Co., San Diego, Calif.

Von Eyssenhardt is in San Diego awaiting delivery of the new 125 h.p., Menasco Ryan S-T which he intends to fly to his base of operations at Roosevelt Field as soon as it is delivered.

Stinson Opens New Sales Branch

STINSON AIRCRAFT Corp., has opened southwestern headquarters at Love Field in Dallas, the third base throughout the country for factory representatives. The others are in New York and Los Angeles. Lee H. Smith, Southwestern sales division manager, has been with the factory since returning from the Orient. Several planes are kept at Love Field.

STANAVO
AVIATION GASOLINE
AVIATION ENGINE OIL
ROCKER ARM GREASE

Constant Speed Prop in Service

A BOEING 247-D transport has been equipped with a constant-speed controllable-pitch propeller and is now in service on United Air Lines. The industry is expected to gain valuable information on the development from United's experience with the new propellers. The Hamilton Standard device, automatically controlled propellers which maintain constant engine speed at all times, was first tested at Hartford, Conn., and then placed in actual service for operations observation.

Faster performance and more efficient operations were reported by pilots who have flown the specially-equipped 247-D.

Dr. Reed Provides Aero Award

AN ENDOWMENT of $10,000 has been provided by Dr. S. A. Reed of New York for an award to be given annually by the Institute of the Aeronautical Sciences for the greatest advance in the aeronautical sciences resulting from experimental or theoretical research, the beneficial effect of which on the development of practical aeronautics is apparent.

The winner of the award will be selected by the Fellows of the Institute and receive a cash prize of $250 and a certificate of merit. The first award will be made at the Annual Meeting of the Institute at Columbia University on January 30, 1935.

Dr. Reed developed the duraluminum airplane propeller, attended Columbia University where he received five degrees including those of Doctor of Philosophy and Doctor of Science, and later studied in the physical laboratories at the Universities of Wurzburg and Berlin. He won the 1925 Collier Trophy.

Six Stinsons Purchased

PACIFIC SEABOARD Air Lines, Inc., has purchased six Stinson tri-motored 10-passenger planes from American Airlines to replace some of the Bellancas now in passenger, express and mail service between Chicago and New Orleans. The Stinson planes will be remodeled to carry seven passengers and to provide larger express facilities.

Douglas Orders 5000 Pulleys

ONE OF the largest orders for Micarta airplane pulleys ever placed amounting to approximately 5000 units, has been received by the Trafford, Pa., micarta works of the Westinghouse Electric and Manufacturing Co., from the Douglas Aircraft Co. The pulleys serve as guides for the control wires leading from the pilot's seat to the ailerons, rudder, elevator, wheel brakes, etc.

New Maps to Be Issued

AIRWAY MAPPING has been put on a quantity production basis by the Bureau of Air Commerce, Department of Commerce, according to Eugene L. Vidal, Director of Air Commerce.

More than 100 new workers have been employed, new airplanes and other equipment have been purchased and plans made for completion by June 30, 1935 of the Bureau's sectional airway map series for the entire United States. Under the original map-making program, ten more years would have been required. These maps are compiled and printed for the Bureau of Air Commerce by the Coast and Geodetic Survey of the Department of Commerce.

Eighty-seven maps are required to cover the United States. Of these, 28 have been printed and are now in circulation. There are 59 yet to be compiled, checked and printed.

• FOREIGN NEWS IN BRIEF •

Australasia

PLANS FOR service between Townsville, Queensland, and Melbourne, Victoria, have been formulated by New England Airways, Ltd., and orders placed for 10-place and 4-place Monospar airliners. It is possible the Sydney-Brisbane service will be extended to Townsville.

C. GATENBY is taking delivery of a new autogiro for use in the inland and mountainous districts of New Guinea. The machine will accommodate a pilot and two passengers and will be used to carry cargo and supplies to Edie Creek, and to outlying gold miners, prospectors and survey parties working in sections inaccessible by other planes.

THE AUSTRALIAN Inland Mission is planning to maintain a second "Flying Doctor" so that patients may be reached over a greater area. It is proposed to establish six new radio posts, with the original flying doctor, Dr. Allan Vicars, probably taking over the new venture.

Shell photograph

Westland-Hill Mark 5 Pterodactyl powered by a 700 h.p. Rolls Royce Goshawk engine

THE HIGH Commissioner of New Zealand has ordered six standard Moths with 150 h.p. Gipsy engines.

CARRYING AN Aerial Survey party, the *Southern Cross* returned from one of the longest aerial journeys yet made in Australia. Since leaving, September 22, the plane flew 11,000 miles in the Northern Territory, and the northern portion of West Australia.

THE FEE on correspondence intended for transmission by air mail in the United States was increased to 7d. per half ounce. This fee is in addition to the ordinary charge prescribed for mail from Australia to destination, and is to be prepaid in Australian postage.

Canada

AIRPLANE SERVICE in New Brunswick carrying passengers and freight between Saint John, Fredericton, Moncton, Summerside, Charlottetown, Sydney, Halifax, Truro and New Glasgow will be inaugurated early this year if plans now under consideration materialize, it was announced recently by B. Gordon Elkin, secretary-treasurer of the new Eastern Canada Air Lines, Ltd.

Plans involve the expenditure of $100,000 and the purchase of five English planes equipped to carry five persons, freight and mail.

Officers and directors include W. M. Humphrey, president; Dr. John B. Reid, vice-president; Senator Creelman MacArthur; W. F. Lane; and Senator C. W. Robinson. R. T. McCully has been appointed managing director and headquarters of the company are at Moncton.

France

AIR FRANCE and Aero Portuguesa are cooperating in maintaining a commercial service between Lisbon and South America. The Portuguese company operates between Lisbon, Tangiers and Morocco, flying tri-motored equipment accommodating six passengers.

CHILE HAS renewed for five years its air mail contract with Air France and unless otherwise terminated, it will be renewable at the end of that time for a similar period, provided the company reduces by 72 hours the time of its service between Chile and France within 18 months of the date of the recent renewal. The air mail rate has been made flexible, maximum and minimum rates being in effect in most cases so that the Chilean Post Office will be able to equalize payments to the company.

Great Britain

SIR PHILIP Sassoon, Under-Secretary of State for Air, revealed in the House of Commons recently that the latest type of plane to be supplied to the Royal Air Force attains in level flight and with full military load, a speed in excess of 230 miles an hour.

The machine is the Gloster *Gauntlet*, a single-seat fighter biplane powered by a supercharged Bristol *Mercury* engine which develops full rated horsepower up to 15,500 feet. Its maximum level speed is 231 miles an hour and it climbs to 20,000 feet in 9 minutes 25 seconds. Sufficient planes of this type have been delivered to equip a squadron of the Home Defence Force, Sir Philip reported.

PILOTS OF the School of Army Cooperation at Old Sarum, near Salisbury, England, are being instructed in the use of the new *Rota* (C.30.P) direct control autogiro for army liaison duties. Six of these machines, built by the Avro company have been delivered and they are being used so that their greatest possible military value can be ascertained.

THREE NEW Napier *Culverin* 720 h.p. oil-burning compression-ignition engines are replacing gasoline burning engines in the Blackburn *Iris* flying boat which has formed part of the standard equipment of the Royal Air Force squadrons for some years. A series of experimental flights with the boat is planned to determine to what extent use of oil-burning engines can lessen fuel consumption and increase range or military load and to clear up installation problems of oil-burning engines.

The Napier company is now engaged in the development and manufacture of two heavy oil units, the *Culverin* and the 550 h.p. *Cutlass*.

Holland

INCREASES IN traffic for 1933 have been reported by K. L. M., the Royal Dutch Air Lines. Mail totaled 87,650 pounds, while passenger traffic, both in numbers and miles flown, also increased. 40,082 passengers, compared with 20,877 in 1932, were carried last year, while there was an increase of 110 per cent in the number of passenger miles flown in 1933 over 1932. Plans have been completed for the inauguration of two new-type Fokkers over K. L. M.'s lines. One is a Wright Cyclone powered monoplane carrying 16 passengers and the other a P. & W. powered airliner with accommodations for 10 passengers. Each has sleeping accommodations and both cruise at about 140 miles per hour. They are to be considered as the future standard types of airliners on the Amsterdam-Batavia route, which will make Java in six days.

Russia

THE FIRST semi-rigid airship *Osoviakhim* made its maiden flight over Moscow with Gen. Umberto Nobile and an entirely Russian crew aboard. The ship is the largest lighter-than-air craft yet constructed in the Soviet Union, containing 706,000 cu. ft. of gas. It is driven by three engines, carries a 12-man crew and may remain aloft three days. Its cruising radius is 1800 miles. The *Osoviakhim* is of the same general type as the *Italia*.

THE LENINGRAD District Red Cross Society has received its first amphibion to be used in bringing patients from the interior of the district to Leningrad in emergencies. The ship will be operated as a regular ambulance, with a physician, nurses, etc.

South America

URABA, MEDELLIN and Central Airways, Inc., known as the "Umca" Line, operating a passenger and express service between Cristobal, C. Z., and Medellin, Columbia via Turbo, with two flights in each direction weekly, has received authorization from the Government of Colombia to extend its operations from Medellin to Bogata. With the entry of the new line into Bogota, the capital city will become a terminal for three air transport companies providing passenger and express service. It is stated that scheduled flights between Cristobal, C. Z., and Bogota, via Medellin, by Umca will be undertaken in the near future when it receives several new planes now on order.

CONSTRUCTION HAS been begun on Colombo Airport by the Ceylon Government at Ratmalana. This site is considered especially suitable in view of its close proximity to a lake where seaplane landings would be possible. It is expected air mail service will be operated by Tata Sons, Ltd., under contract with the Ceylon Government. This firm is well established in India, and will continue its service to Colombo with its own planes, handling only mail at first, with the possibility of adding passenger service later on. The Ceylon Aero Club, with a membership of 120, has requested the Government that it be allowed to collaborate in the airport and building construction.

WORK ON a two-runway landing field for Santa Ana, El Salvador, is being rushed in order to have it finished in the immediate future. The city has long wanted its own airport, but previous work had always been delayed because of lack of funds. Local citizens are so interested that the work is being carried on by public subscription, which was also instrumental in the inauguration of a new airline by Transportes Aereos Salvadorenos. Passenger, mail and express service was initiated with an American plane flown by a Salvador army pilot who is on leave to develop the project.

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TRADE LITERATURE

Douglas DC-2

• DOUGLAS AIRCRAFT Co., Santa Monica, Calif., has just issued a new booklet, the "Douglas Transport DC-2," featuring its newest luxury airliner. Most complete from an illustrative point of view, it also describes fully the transport's passenger accommodations, its soundproofing and ventilation system, cargo facilities, wing structure, flaps, landing gear, and other constructional details of interest.

An interesting table indicates the low-level decibel range of the plane, while other tables show engine data, range and payload, specifications and standard equipment. An interesting illustration shows the interior built for executive or private use, the Salon being custom-finished with desks and lounges to meet the most fastidious requirements.

Those who are not familiar with every detail of the Douglas transport, will find in this publication an opportunity of becoming thoroughly acquainted with the most-widely publicized transport in regular service at this time.

High-Tensile Steels

• A NEW group of high-tensile steels manufactured in three grades by seven subsidiary companies of the United States Steel Corp., is described in a new 8-page booklet, "USS High-Tensile Steels for Light-Weight Construction."

These steels, prefixed by the symbol USS, are known as Cor-ten, Man-ten and Sil-ten. The first is a low chromium copper silicon steel, highly resistant to corrosion; the second is a strong manganese steel for installations where corrosive-resistant qualities are not prime considerations, while Sil-ten is a structural silicon steel for applications where neither corrosive resistance nor superior physical qualities are essential.

A discussion of the new steels is contained in the booklet as well as chapters on shop practice and a summary of advantages. A table not only indicates the chemical and physical properties of each metal, but also compares their composition and corrosive resistance.

Air Transports

• UNITED AIR Lines has issued a new 8-page booklet which not only advances informational data of help to the air traveler, but also tells how the Boeing transports are designed and built, what factors safeguard the passengers' safety and what structural advantages are incorporated in its all-metal transport equipment.

Pictorial presentations depict the various steps in the production of the Boeings, showing among other things, a load-to-destruction test conducted by the Army Air Corps on a fuselage and tail section of the ship. Nine separate paragraphs tell the reader of the inspection, care and maintenance of the planes and acquaint him with the measures taken to provide for his safety. A number of testimonials from travelers who have flown with United further evidence the increasing popularity of air travel.

Series H Wasp Engines

• HERALDING THE advent of its new Series H Wasp engines (described in the October, 1934, issue of Aero Digest), the Pratt & Whitney Aircraft Co., E. Hartford, Conn., has just issued a new booklet which is just as attractive as it is informative.

Pictorially complete, the book describes the major sections of the new engines, telling the advancements, advantages and utilization of each.

The first of the H Series ready for commercial use is the Wasp S1H1-G, which is rated 550 h.p. at 2200 r.p.m. at 8000 feet. Complete power curves are included to show horsepower and manifold pressures at sea level and altitudes. Important specifications of the engine are also provided.

Two-tone pages (using aluminum ink) materially help the appearance of the book, making a good job appear even more interesting and inviting.

Collector Rings

• SOLAR AIRCRAFT Corp., San Diego, Calif., has just published a new booklet on engineered exhaust collector rings for airplanes which describes the use of this engine apparatus. Among the problems confronting the engineer of exhaust collector rings are many which are listed and described therein.

A brief history of the introduction of the Solar equipment together with information desired to engineer any particular ring is contained in the booklet as well as illustrations of a few of the many types being built by the company.

Navigation Methods

• NAVIGATORS IN general will be interested in a chart recently published and distributed by the U. S. Hydrographic Office as a Supplement to the North Atlantic Pilot Chart, 1934. The chart shows a tabulation of 29 different methods of navigation dating from 1763 to the present time, listing author, publishers, title and date for each method, showing the formula used, the general description of the method with an example common to each method, an analysis of the steps in the solution, the rules for the method and notes on the advantages and disadvantages of each method. The tabulations are entitled *Résumé of Navigation Methods* by Soule and Collins, copyrighted by the U. S. Naval Institute and reprinted by permission of the copyright owners.

REVIEWS OF BOOKS

AERODYNAMICS
By Dr. L. Hopf

• THIS PUBLICATION will appear in German in three volumes: the first by Dr. L. Hopf treating the subject of mechanics of airplanes; the second by Dr. R. Fuchs on the theory of air forces (theoretical aerodynamics) and the third by Dr. F. Seewald on propellers.

The first volume which has already been published, represents a thorough presentation of present knowledge on mechanics of airplanes including the latest experimental information available. It is neat in form and ably presented. In view of the numerous material and theories included in this volume, it will be found useful particularly because, being uniform in presentation, it is easy to follow and ready to apply.

Among other subjects, this volume treats expertly on the problem of interference, performance, information on cowls, stability (longitudinal, lateral and directional) and other data. The book may be considered a very valuable asset to the recent literature on applied aerodynamics and airplane design. Julius Springer, Berlin, is the publisher.

AIRPLANE DESIGN
By K. D. Wood

• THE AUTHOR of this book attempts to tell how to design an airplane, gives sample layout and stress analysis computations, and aims to include, in appendix form, sufficient handbook material for carrying a design project through its preliminary stages.

Included in the material are sample layout calculations to meet a specified performance by the method of NACA Rept., 408; theoretical development of wing and tail load factors due to gusts with sample computations; sample calculations for preliminary design of primary members of wings, fuselage, landing gear, control system, and tail surfaces for a typical monoplane of modern design; weight and strength of airplane materials and parts, including graphs for preliminary weight estimates; abstracts of the latest technical data from numerous catalogs; and a copy of the new Bureau of Air Commerce Bulletins 7-A and 26, with index.

The publication is available through the Cornell Co-Operative Society, Cornell University, Ithaca, N. Y.

AERONAUTICAL METEOROLOGY

(*Continued from page 23*)

adiabatic charts, where it is then ready for the forecaster's analysis. Aerographic flights are made regardless of weather. The usual height obtained is from about 20,000 to 23,000 feet. In the United States, ten aerographic flights are made in different locations daily.

The education of pilots in practical meteorology toward a working knowledge of the mechanics of the various meteorological phenomena which they encounter in flight, can be of great assistance to the commercial meteorologist. Recognition of this fact by the executives of TWA, led to the establishment of a "Course in Practical Meteorology," conducted by the writer, in which all operations personnel are required to participate. Due to the large number of personnel affected and to the fact that they are located in a great number of cities from coast to coast, the course is being carried on by correspondence.

Aeronautical Meteorology, Revised, by Dr. Willis R. Greeg, and *Meteorology,* by Milham, have been used as reference texts. Articles particularly applicable, such as on thunderstorms, line squalls, fog, ice formation on aircraft, etc., are distributed at intervals.

The backbone of the course, however, is a weekly analysis and discussion of the major meteorological phenomena that occurred over some portion of the airway during the preceding week. A detailed synoptic weather map, or series of maps, depicting the conditions, is prepared in mimeograph form at the Kansas City operations base. Accompanying the map are the forecasts for the airway, the actual weather conditions that prevailed as reported hourly from the stations, a resumé of the flight movement for the period, an analysis of the map describing the influences prevalent, and the reasons, as far as possible, why such weather conditions were forecast.

The object of this latter phase of the course is to establish in the minds of the pilots and ground personnel the reasons the described condition occurred and to familiarize them with the weather map indicative of those conditions while the experience of flying in those conditions is still fresh in their minds.

The results have been gratifying. Interest in meteorology has been stimulated to such an extent that the instructor is hard-pressed to satisfy the requests for more frequent bulletins and discussions. A finer appreciation, resulting in increased flying performance, is inevitable.

Another method by which pilots are being educated in meteorology has just been introduced by the company. Believing that the science can be greatly aided through the medium of photography, TWA has equipped its pilots and co-pilots with cameras and has instructed them to photograph, as often as possible, the upper surfaces and interfaces of clouds and other phenomena observed during flights.

Since the form and texture of the underside of cloud layers is of invaluable use in weather prediction, meteorologists have concluded that careful examination and comparison of photographed upper-surface interfaced cloud effects may possibly reveal, or indicate, what is going on underneath, or even predict the weather to be expected in the direction in which the plane is traveling.

Each photograph is accompanied by such information as location, date, time, altitude of plane and of top cloud layer, air temperature, and weather conditions. As the photographs and data are collected, meteorologists will correlate them with known surface weather conditions, draw conclusions, and thereby, it is hoped, assist materially the accuracy of weather forecasting.

The collection of weather reports, issuing of forecasts, and the instruction of personnel in meteorological matters are routine duties of the Weather Department that principally effect the pilot. While such duties do not actually produce sav-

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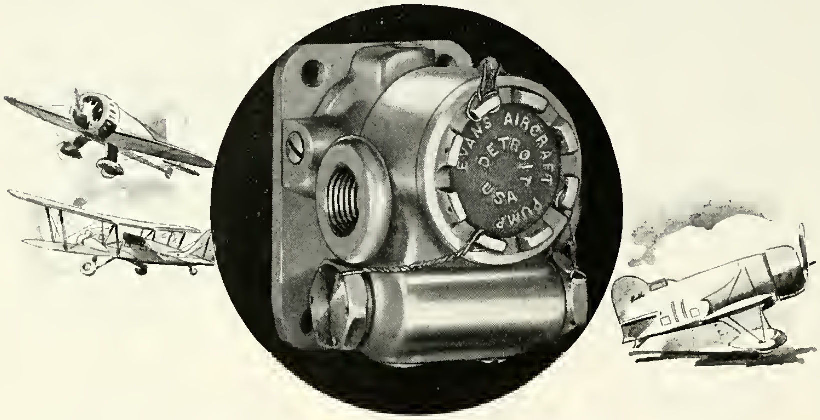

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ings in operating expenses, there are other functions of the meteorological department which do.

For example: from a study of weather maps and from pilot balloon observations (there being in excess of 40 stations in the United States which make balloon soundings four times daily) the meteorologist can advise at what altitude there are favorable winds. The direction and velocity of air currents is not constant with increased altitude. Their change in direction is frequently as great as 180° and velocities usually increase with altitude up to a general height of 16,000 feet and then decrease for 5,000 feet or more before another increase prevails. The latter, however, varies considerably during different seasons of the year. Unless the pilot has definite information at what altitude to fly, additional time is required to complete the schedule or the engine r.p.m., must be increased. Both result in increased cost of operation. Greater acceleration of the engines requires greater fuel consumption.

Increased time in completing a schedule increases cost at the rate of $50 an hour for large planes and $25 an hour for single engine ships.

Further, by advising dispatchers of the probable flight movement for the following 24 to 36 hours, considerable expense in ferrying equipment (non-revenue flights) can be avoided.

There also are times when weather conditions make it advisable to cancel operations over certain areas for the time being. The traffic department is vitally interested in having this information well in advance. Passengers who have made reservations are entitled to know if the flight is to be completed on schedule, or if there is a probability that a flight cancellation or delay will result at some point enroute. This helps not only to build up good-will but also establishes a reputation for dependable operations.

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FAIRCHILD 22: Cirrus Hi-Drive, 335 hours, 8 since engine major; licensed, like new, extras; no reasonable offer refused; trades considered. Valley Airways, Inc., Winchester, Virginia.

BARGAIN: Stinson Lycoming, model SM8A; 4-place; rate of climb, bank and turn, air speed instruments; retractable landing lights, flares, brakes; just refinished; licensed November, 1935. Located Orlando Airport. J. M. Farrington, Winter Park, Florida.

FOR SALE: 3-place Spartan biplane, in excellent condition. 120 h.p. Walters motor, overhauled and recovered this year. Price $750 cash. Fred Moller, Mollison Airport, Stratford, Connecticut.

J-4 WACO: Looks good and is good. Licensed to August, 1935. $785 cash. W. F. K., Stratford Hotel, Washington, D. C.

N-B 8, NEARLY NEW: Finished in red and white, chrome struts, many extras. Will accept cash, another airplane or an automobile in trade. Terms. Jim Kukla, Western Hills Airport, Cincinnati, Ohio.

GERMAN KLEMM: Converted to light flying boat. Salmson 9-cylinder 40 h.p. in need of minor repairs. Will sell as is for $100. E. Closs, Sparta, New Jersey.

TAYLOR CUB: Only 180 hours total. Licensed until December 1935. Excellent condition. No trades. Make offer. A. G. Becker, Dravosburg, Pennsylvania.

WACO TEN: Completely rebuilt. J-5 Waco, newly recovered. Hisso Eaglerock. Axelson Ryan Speedster. Kinner Waco F. All in first class condition, priced right. Charley Raudabaugh, 13210 French Road. Detroit, Michigan.

BIRD: Kinner 100 h.p. front exhaust. Just licensed. Airwheels, extras. Complete overhaul July. Excellent condition. Ship guaranteed. $1,450. The Walz Corporation, Central Airport, Camden, New Jersey.

ALL METAL 5-PLACE Thaden T-4: Wright J6, high speed, 140 m.p.h., licensed for transport, private use, $1,600. Cash, terms. Pioneer Aviation Co., Airport, Syracuse, New York.

TRAVEL AIR S-6000-B: Wright Whirlwind, 330 h.p. engine, modernized; licensed to January, 1936. Six-place cabin; new leather upholstery; bank and turn, rate of climb, landing lights, two three-minute flares, metal propeller; color, white with blue trimmings; always hangared and kept in excellent condition. Will sell or trade for smaller plane. Galveston Flying Service, Inc., Galveston, Texas.

DE LUXE WACO CABIN: '32 model; 210 horsepower, many extras, including ambulance equipment, $2,800. Also Fairchild 22, clean job, just relicensed, $1,400. J. T. Moore, Jr., Reading, Pennsylvania.

J-5 PITCAIRN, PA-7 SHIP: Brand new and complete. Licensed to September, 1935. Will sacrifice for immediate sale. $1,500 cash. Silver Star Airport, Langhorne, Pennsylvania.

WACO TEN, OX-5: Licensed September, 1935. Turns 1410 on ground. Ship, motor just overhauled. A-1 condition. 12 hours since overhaul. Duals. $425 cash. I. Tepper, 7205 Park Heights Avenue, Baltimore, Maryland.

WACO "C": 1933 Cabin with Continental R-670 engine. Aircraft time, 240 hours; engine time, 295. Top overhauled at 275 hours. Extra equipment includes: Lear Model F radio, landing lights, direct electric starter, Eclipse generator (15 amperes), bank and turn, rate of climb, air brakes. This ship has been privately owned and is in excellent condition. $3,750 fly away, duPont Airport, Wilmington, Delaware.

SACRIFICE DeLuxe "S" Stinson, $2,400 cash. Perfect condition. Pants, rate of climb, turn and bank, retractable landing lights, Westport radio. Just relicensed. Write or wire Warren J. White, Albany Airport, Albany, N. Y.

MUST SELL: 4-place 185 Challenger Robin. Licensed, Bendix wheels, special brakes, tail wheel. No reasonable offer refused. A. F. Burrill, Marlboro Airport, Marlboro, Mass.

J-5 CESSNA: Speed ring, brakes, compass, air speed indicator; 318 hours total; licensed to June, 1935; 170 top speed; $850. Bill Kysor, Niles, Michigan.

FOR SALE OR TRADE: Kinner Waco F; Menasco Waco F; J6-7 Waco Taperwing; J6-9 Buhl 6-place cabin; Menasco 125 late type motor. All licensed and priced to sell. R. Stuart Weeks, Port Huron Airport, Port Huron, Michigan.

B-5 KINNER BIRD: Three-place, dual instruments and brakes front cockpit. Air starter, steel propeller and lights. Ship and motor completely rebuilt June, 1934. Licensed to July, 1935. Will consider in trade two-place Aeronca, Taylor Cub, or Monocoupe. Also have for sale Fairchild 22 and J6-7 Waco. Frank Pratt, Natick, Massachusetts.

AIRPLANES FOR SALE: Lockheed Vega, 7-place; Fokker F-10; Ford, 3 Wright 300 h.p.; Travel Air cabin, J-6 300 h.p.; Great Lakes; Waco F. Charles H. Babb, Grand Central Air Terminal, Glendale, California.

REARWIN JR.: Nearly new. Late Szekely. Licensed till September. Winter enclosure. Price, $650. Consider car part payment. Monty Barnes, Municipal Airport, Wichita, Kansas.

STINSON SM 2: J6-7. Thirty-six hours since major. Completely reconditioned and being repainted now. Excellent ship for getting in and out of small fields. $1,150. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO F: Warner motor, speed ring, front cockpit cover, turn and bank, steel propeller; little time; appearance like new. For complete description write: W. L. Burall, 2103 Chelsea Terrace, Baltimore, Maryland.

FOR SALE: Waco F-2: Continental. Excellent condition; complete night flying equipment. Speed ring, air starter. Licensed September, 1935. $1,800. R. W. Brillhart, Fairfax Airport, Kansas City, Kansas.

TRAVEL AIR SPORT: $1,950. Kinner B-5 125 h.p.; starter, speed ring, rubbed finish. J-5 Eaglerock, $985; overhauled, licensed December, 1935. Trades considered. Kinner K-5 parts. Front exhaust heads, $30; main case, $50. Dick Schall, Berwyn, Maryland.

FOR SALE: J6-5 powered Curtiss Robin, best possible condition, licensed; many extras, including speed ring, bank and turn, navigation lights, etc. Only $925 for quick cash sale. Aircraft Mechanics, Inc., Colorado Springs, Colorado.

SPECIAL ARISTOCRAT 3PCLM: Completely modernized Wright J-6, 175 h.p.; fully equipped, including leather upholstery, complete Pioneer instrument board, speed ring, semi-balloon wheels, pants and fairing on all struts and fittings. 300 hours total. Price, $1,600. Will trade. R. F. Hoey, Hangar 3, Floyd Bennett Field, Brooklyn, New York.

WACO CABIN, CONTINENTAL: Special paint; pants, air brakes, flares, landing lights; radio; every possible instrument; never scratched; motor just majored, ship just relicensed. Not a year old. Beautiful condition. Cost $8,400. Bargain for cash. Might trade for Reliant. AERO DIGEST, Box 1949.

WACO F: Kinner B-5 engine. Standard equipment; never cracked; must be seen to be appreciated. Cheap for cash. Hardy Young, Municipal Airport, Oklahoma City, Oklahoma.

CHALLENGER FLEDGLING: Instruments both cockpits. Kinner-powered Taylor two-place monoplane. Licensed until October, 1935. $650 each. Camel City Flying Service, Winston-Salem, North Carolina.

ARROW SPORT plane: 65 LeBlond engine; motor and plane in good condition. Licensed to June, 1935. $500. A. F. Kaufman, 710 East Gift, Peoria, Illinois.

UNUSUAL BARGAIN: OX Robin, new motor and prop; duals; air speeds; eligible license. Consider trade on open job or $385 cash. Turner Flying Service, Spartanburg, South Carolina.

STINSON JR. "S": Ship and motor perfect condition. Never damaged. 220 hours since major overhaul. Privately owned. Equipped night flying, duals, rate of climb, turn and bank and other extras. Always hangared. $1,980. Robert Gross, Transcontinental Airport, Toledo, Ohio.

OX-5 TRAVEL AIR: Licensed to April 1, 1935; motor and ship in excellent condition; $500. Write Wayne Jokiletto, 2810 Ohio Avenue, Ashtabula, Ohio.

HUNDREDS of used planes. Crack-ups, parachutes. OX jobs, $90 up. Send 20c for Directory containing owner's price, name and address. Used Aircraft Directory, Athens, Ohio.

LATEST MODEL Aeronca Scout: Just relicensed and motor majored. Factory floats and landing gear. Condition excellent. $475 cash. J. Thomas, 1568 Cherokee Road, Louisville, Kentucky.

WE WILL TAKE any licensed airplane in trade on any new Fairchild. Send complete details concerning your ship in first letter and we will give you an immediate estimate of its trade-in value. St. Louis Flying Service, Fairchild Distributors, Lambert Field, Robertson, Missouri.

FLEET KINNER: Less wings, in need of recovering and minor repairs; engine in perfect condition, just majored; Heywood starter. Sacrifice price, $400. E. Closs, Sparta, New Jersey.

FAIRCHILD FC-2 with J-5. Five-place. 70 hours since complete overhaul; total 600 hours. Wiley flares, wing landing lights. Excellent condition. Guaranteed. $1,500. The Walz Corporation, Central Airport, Camden, New Jersey.

CURTISS JR.: Repossessed by finance. Just reconditioned completely; opportunity for quick sale, can be purchased on small down payment, balance monthly. Pioneer Finance Dept., Airport, Syracuse, New York.

FOR SALE AT BARGAIN: J-6 330 h.p. B-5 6-place Ryan cabin ship. Equipped with Goodyear full Airwheels and brakes. Excellent set of instruments. Licensed till September 1935. Will accept lighter ship as part payment. Michigan Aero Motors, Jackson, Michigan.

FAIRCHILD 24: 125 h.p. Warner, 185 hours, $2,500. Cessna J6-7: A-1 condition, no reasonable offer refused. OX-5 Challenger: 30 hours since major. All ships licensed. Princeton Airport, Rocky Hill, New Jersey.

EAGLET: Szekely 45 h.p., completely rebuilt and recovered. In perfect condition every respect. $575. Rising Sun Aircraft School, Inc., 857-67 E. Luzerne St., Philadelphia, Pennsylvania.

J-5 STEARMAN: Latest type, major overhauled, in perfect condition throughout, new motor, deliver anywhere, make offer. Aeromarine Klemm: Recovered, A-1, cheap. Sell less motor. Terms. Miller Flying Service, Montclair, New Jersey.

AERONCA C-3: No time on plane since completely recovered at factory. 75 hours on motor since major factory overhaul. Cannot be told from brand new. Location Cincinnati. Write AERO DIGEST, Box 1951.

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PLANES AND ENGINES FOR SALE

STANDARD D-29A: With B-5 Kinner motor. Latest type cylinder heads. Heywood starter. Ship and motor in absolutely perfect condition. Ideal training ship. Write AERO DIGEST, Box 1952.

BRIGGS SKYLARK: Rover-powered; 675 hours; ship refinished, engine majored. Aeronca 2-place, 600 hours, engine rebuilt. Both ships licensed, in excellent condition. Trades considered. Air Activities Airport, West Chicago, Illinois.

ENGINES GUARANTEED MAJORED: Hornet A-1, $600; Wasp C-1, $1,000; Wasp B, $700; Wright J6-7, $800; Warner 125 h.p., $475; Kinner K-5, $300. Charles H. Babb, Grand Central Air Terminal, Glendale, California.

AERO BARGAINS: A used aircraft directory listing flyaways, crack-ups, motors and equipment. Send 15c (preferably in coin) for your copy to Aero Bargains, Greenville, Ohio.

MONOCOUPE VELIE: Like new. Only 275 hours; speed ring, inclinometer. Licensed until December 1935. Make offer. Will consider Taylor Cub in trade. A. G. Becker, Dravosburg, Pennsylvania.

TRIAD TRIMOTOR: 4PCLM, 3 LeBlond 65's; recovered, licensed June 1935. Total time, 242 hours. Sell for price of motors, $975. Frazier, 308 So. 11th, Lincoln, Nebraska.

TRAVEL AIR: Model 4000. 380 hours total. Duals, airspeed, compass, navigation lights, pitch and bank. Always hangared, never cracked. 100 h.p. Kinner front exhaust, late type. 105 hours total. Licensed October 1935. Price $950. J. Hagan, 377 No. Pearl St., Albany, New York.

FOR SALE: Straight Wing Waco J6-5, just relicensed; motor has 15 hours since overhauled by leading airline, $1200. RCA radio and motor shielding, $125. Ryan lights, per set, $50. Flare pistol and one flare, $30. 1½ minute flare, $20. Walter C. Hartman, 4061 Vinceton Street, Pittsburgh, Pennsylvania.

TRAVEL AIR: Challenger 185; licensed; steel prop, speed ring, windshield, Goodyear airwheels, brakes, landing and navigation lights, complete blind flying equipment; never damaged; few hours; a buy, $1,150 cash. Set Bendix 30 x 5 wheels, tires, tubes, brake assembly, $22.50. Eaglerock control surfaces, cheap. Mankato Aero Service, Mankato, Minnesota.

FOR SALE: Warner motor with steel prop. Siemens-Halske 70. LeBlond 65. OX-5 Robin. Command-Aire. Waco. Velie Monocoupe. Licensed, will trade. AERO DIGEST, Box 1955.

FLEET MODEL 9: De Luxe; Kinner 125; good as new, with many extras, including pants, the best one around. Also two Fairchild 22's, with inverted Cirrus engines; one only flown 10 hours and is a real buy, the other one in wonderful condition and priced right. AERO DIGEST, Box 1956.

J-5 TRAVEL AIR 4000: Excellent condition and sporty paint job. Ideal, and equipped for banner towing. $1,100. Deliver for expenses. Roger Pennock, 501 Cooper Street, Camden, N. J.

FOR SALE OR EXCHANGE: 11 Certified Airplanes, as follows: J-6 B-5 Ryan cabin ship, air wheels; LeBlond-powered 2-place Davis monoplane; J-6 6-place Stinson cabin ship, air wheels; J-5 B-1 Ryan cabin ship; 2 OX-5 Waco 90's; 2 J-5 Straight Wing Wacos; J-6 250 h.p. Straight Wing Waco; Wasp-powered Travel Air cabin ship; J-6 330 h.p. straight wing Waco. All ships NC licensed and ready for delivery. Good late model cars taken on deals. Terms to responsible buyers. Becker-Forner Service, Inc., Jackson, Michigan.

BUHL J6-9 WRIGHT 300: Six-place. Battery, generator, landing lights, rate of climb, bank and turn, radio. Just completely reconditioned and recovered. Beautiful blue and red handrubbed paint job. A beautiful ship in excellent condition. $1,900. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WARNER STINSON: Cabin; 125 h.p.; motor just overhauled; complete, excellent condition; 1935 licensed. See this airplane. Only $685, flyaway Pioneer Aviation, Airport, Syracuse, New York.

WACO J6-5 Straight Wing: Total time on ship and motor, 350 hours. Motor modernized and has 75 hours since major overhaul. Ship was completely recovered recently. Painted white fuselage and vermilion wings. Price, $1,400. Will accept trade. Andy Stinis, Floyd Bennett Field, Brooklyn, New York.

FAIRCHILD 22's, Warner, Cirrus and Gipsy; 24's, Warner and Cirrus. Fleet, Fokker Super Universal, Lockheed Vega, Wasp Laird, Warner and Lambert Monocoupe, Stinson Jr., Reliant, Travel Air 6000, Stearman, Waco C, Great Lakes, Stinson Trimotors, Bellanca Skyrocket. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

PITCAIRN J-5: Less than 25 hours since complete recover and motor overhaul by Curtiss-Wright. Full airwheels. Curtiss Reed metal prop, recently etched. $1,500. Terms. G. M. Downs, Municipal Airport, Ann Arbor, Michigan.

SPARTAN LOW WING: Jacobs 55 h.p. Rubbed gloss finish, black and white. Motor just overhauled. Excellent condition throughout. $1,000. Walz Corporation, Central Airport, Camden, New Jersey.

DE LUXE KINNER FLEET: Model 9. Like new; privately owned. Always hangared, never cracked. Only 318 hours on ship and motor. 125 h.p., cruises at 97 m.p.h. Five hours cruising range. Dual controls and brakes. Starter. "Steerable" tail-wheel; navigation lights. Licensed to July, 1935. Leather upholstered roomy cockpits; baggage compartment. Fabric excellent throughout. Yellow wings, green fuselage, black cowling. Instruments rear cockpit; extra airspeed front cockpit. Priced right at $1,700, no compromise, no brokers. Ship can be seen and demonstrated at Red Bank Airport, Red Bank, New Jersey.

STINSON MODEL R: Very good condition; privately owned. 268 hours total. Fully equipped, including radio. John H. Shobe, American Airlines Hangar, East Boston, Massachusetts.

TRIMOTOR LYCOMING STINSON: Model T. Licensed 10 passengers and pilot, completely equipped for night flying; lavatory, air wheels, new hydraulic brakes, spare tire and tube. Selling price $3,500; can finance approximately 40% for responsible party. Will consider trade. Lycoming Motor: New style crankshaft. Time since overhauled, 213 hours. $400. Curtiss Fledgling: Excellent condition; recently recovered. Safest training plane available, $900. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

FOR SALE OR TRADE: Late 1933 Waco Cabin. Many extras. Ship and engine brand new condition; will consider smaller type ship or car in trade. Inquiries invited. Dr. George F. Lindig, 745 Fifth Ave., New York, N. Y.

TRAVEL AIR SPEEDWING: Sale or trade. Wright J6-7. No time since major. Specially stream-lined; very fast; extra gas; excellent condition; just relicensed. M. M. Osterberg, 410 East 57th Street, New York, N. Y.

BARLING NB-3: LeBlond 60 h.p. motor; just majored; just relicensed; no reasonable offer refused. E. A. Fulton, 100 New York Avenue, Baldwin, L. I., N. Y.

BEECHCRAFT: For sale or trade. Jacobs motor, 40 hours; ship equal to new. Special paint, upholstering, instruments; excellent condition. AERO DIGEST, Box 1957.

COMMAND-AIRE OX-5: For sale. Also spare OX-5 parts. Ship needs repairs. Located New York territory. No reasonable offer refused. AERO DIGEST, Box 1958.

LICENSED VELIE MONOCOUPE: New propeller and Pyralin. Covering excellent. Priced for quick sale, $425. Hamilton Steel prop for OX-5 or -6, cheap. N. H. Chevrolet Co., Wakefield, Nebraska.

J-6 FORD TRIMOTOR: Motors newly overhauled, propeller reconditioned; speed rings on outboards. Ship in perfect shape. Total time, 900 hours. Many spare parts included. $5,500. J. Wood, 1238 N. Lombard Ave., Oak Park, Illinois.

FAIRCHILD 71: Wasp C, on floats; Fairchild 51, Wright J6-9, with floats, wheels or skis; Waco J-5 Straightwing, ship and motor just rebuilt; Curtiss Robin J6-5; American Eagle (late type short nose), full air wheels, Kinner 100 h.p. front exhaust; Crescent 8-place, J6-9, motor just rebuilt and modernized, ship recovered; others. Barnes Air Service Co., Westfield, Massachusetts.

J6-5 ROBIN: First class condition, newly recovered and refinished. No time since. Two good parachutes. Wisconsin. AERO DIGEST, Box 1959.

ALEXANDER FLYABOUT: Cabin monoplane, guaranteed Szekely steel cylinder motor, dual, air wheels, cabin heater; economical to operate. $595 Flyaway. Pioneer Aviation, Airport, Syracuse, New York.

BIRD: Kinner K-5, front exhaust. Collector ring. 685 hours, 75 since overhaul; fabric excellent. Semi-air wheels; oleos; Pioneer instrument; very clean ship. $1,050. Henson Flying Service, Hagerstown, Maryland.

MONOCOUPE: Model 110 Warner 125 motor; always hangared, excellent condition; 550 hours total time; air wheels; licensed until October, 1935. Carl B. Haun, Blackwell, Oklahoma.

WACO STRAIGHTWING: J6-5. Wheel pants, speed ring. Consider Taylor Cub in trade. Lycoming Engine: Major overhauled, prop; reasonable. Jerry Kelsey, Municipal Airport, Philadelphia, Pennsylvania.

FOR SALE: Lycoming Model R Stinson (large tanks), $2,500. J-5 Travel Air, all white lustre finish, $1,550. One pair 650-10 airwheels and brakes, $60; one 10 x 3 tail wheel assembly, $12.50; complete tail group for Travel Air Sport; J-6 Series E cylinders, diffuser section; F-141 direct electric starter, etc., at list less 60%; one J-5 steel propeller, $80; one used J-5 engine, $250; one steel propeller for J6-5; also used J-5 parts cheap. Trades considered. We pay spot cash for crack-ups and specialize in high lustre finishes at reasonable prices. Mackey Flying Service, Findlay Airport, Findlay, Ohio.

FOR SALE: 6000-B Travel Air cabin monoplane; Lycoming Stinson Jr.; Curtiss Fledgling; Wasp C. Stearman; Loening Commuter. O. J. Whitney, Inc., Glenn Curtiss Airport, North Beach, N. Y. NEwtown 9-0300.

STINSON JUNIOR SM2AB: Good condition, engine just overhauled, lights and flares, relicensed to July, 1935; $1,100. Warner Cessna: Recently recovered, beautiful finish, tail wheel, lights, bank and turn, rate of climb, licensed to September, 1935; $850. Taylor Cub: Recently recovered, A-1 condition, licensed to June, 1935, $795. Louisville Flying Service, Bowman Field, Louisville, Kentucky.

FOR QUICK SALE: 125 h.p. Warner Davis. Complete, including speed ring, pants, oleos, instruments front and rear cockpits, brakes, high gloss finish, many extras. Beautiful ship, fine performer. Exceptional bargain, $1,200. E. Turner, Boulevard Airport, Philadelphia, Pa.

NEW WRIGHT GIPSY engine: Brand new, in crate, ready for shipment. $350. Guaranteed. R. J. Wenger, 6718 McKinley Avenue, Los Angeles, California.

MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

JOIN THE U. S. AERO UNITS and learn flying at the lowest cost. We will place a new ship at your airport. Write for description of plan. Units are now operating and being formed all over the country. U. S. Aero Units, Inc., 122 East 42nd St., New York, N. Y.

450 QUESTIONS and Answers, covering Dept. of Commerce examinations. 58 pages. Several sketches. 300 for Pilots, $2. 150 for Mechanics, $1. Both books, $2.50 postpaid. Ruch, Box 652, Newport, New Hampshire.

GOING SOUTH for winter; can take along student who wants to learn aviation and build up time for transport license. Full time for license, board and transportation for $1,250. AERO DIGEST, Box 1943.

WINTER STORAGE: Our dead storage rates are ten dollars per month for average plane. Will call for your ship and deliver to you next summer for expenses. Airport, Natick, Mass.

LEARN TO FLY: $3 per hour solo; $6 dual. Pay as you fly. Further reduction in quantitties. Aircooled, licensed equipment. Barnes Flying Service, Municipal Airport, Wichita, Kansas.

50 HOURS FREE flying time, including instruction to partner with $400 cash. Have Curtiss flying boat with extra motor, licensed. Ready to barnstorm South. Partnership includes half interest in ship and profits. Aviator, 9202 Skidmore Ave., Brooklyn, N. Y. Phone: SKidmore 4-3372.

HERE AT LAST: Three instructive booklets on stunt flying, inverted flying, and the installation of the inverted fuel system. These booklets are written by one of the Mid-west's premier Air Show stunt pilots, in a way easy to understand. This practical information is yours for only 15c per copy. Mail stamps or carefully wrapped coin to Lieutenant Joe Mackey, Findlay Airport, Findlay, Ohio.

THE NEW YEAR WAY: Keep flying all winter. $3.50 solo; $5.50 dual. New ship, cabin, heater, brakes, insurance; 30 minutes from Grand Central by subway. Phone Edwards Flying Service, Flushing Airport, Flushing, N. Y. INdependence 3-4843.

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10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

WANTED TO BUY OR TRADE

TRADE YOUR cracked-up or worn-out airplane for credit on new Fords, any model, or good used automobiles. Western Hills Airport, Cincinnati, Ohio.

WANTED: Collapsible rubber boat to take on over water flight. Will buy or rent. Must be in perfect condition. AERO DIGEST, Box 1944.

HAVE CASH for J-5 Waco, Travel Air or Fleet, or similar ship. Give full description and best price, first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

WILL TRADE 1934 Pontiac sedan and OX Robin with air wheels, other extras and cash for late Fairchild, Waco or other cabin ship. Must be late model and few hours. Earl Walker, Sullivan, Illinois.

WANTED: Fuselage and wing for Lambert Monocoupe, connecting rod assembly, 5 cylinders with pistons for Lambert, pair rudders, Edo floats No. 2260, Eclipse or air starter for Warner 125, Continental 165, Warner 145 or J-5. Miki, 272 West Flagler Street, Miami, Florida.

WANTED: 2- or 3-place open tandem ship, licensed; 55-125 h.p.; air-cooled; duals; good condition. AERO DIGEST, Box 1945.

WANTED: Wheel pants and brackets for 22x10-4 airwheels; steel propeller for Cirrus Great Lakes; Aeronca E-113-A motor; Franklin glider. J. Thomas, 1568 Cherokee Road, Louisville, Kentucky.

CASH for used planes and engines. Waco, Fairchild, Fleet, Cub, Aeronca, etc. No objection if damaged, but must be repairable for licensing. Give location and full details first letter. AERO DIGEST, Box 1950.

WANTED: Two J-5 Stearmans, one Kollsman sensitive altimeter. For Sale: One Crosley D.O.C. radio; one J-5 Bellanca, 6-place, full night and blind flying equipment, also radio; or will trade Bellanca for ship in Stearman class. Greer Flying Service, Municipal Airport, Memphis, Tennessee.

WINGS FOR FLEET: Must be sound; give condition of cover if any and lowest cash price in first letter. E. Closs, Sparta, New Jersey.

WANTED: Aeronca, Velie Monocoupe, Nicholas-Beazley, Jacobs Spartan or similar plane. Give full description. Send photo if convenient. Cash for bargain. Merlin Ferrell, Wallace, Nebraska.

HAVE CASH for good Lycoming motor, propeller and starter. Give full description, hours and best price at once. Michigan Aero Motors, Jackson, Michigan.

WANTED: OX-5 motor mount and streamlined wires for long-nosed American Eagle. Gordon C. Sands, Havre, Montana.

WANTED: New or used K-5 Kinner, with new type heads. If your price is reasonable, write to Frog's Flying Field, Inc., East Moriches, N. Y.

WANTED: Lycoming Stinson. Consider ship needing recovering, motor overhaul or rebuilding. Give full details and lowest price. Other ships considered. John Papay, 2032 West 48th St., Cleveland, Ohio.

FLOATS WANTED: Model size 1525, 2260, 2665. State age, condition and lowest cash price. Ships wanted: Slightly damaged or in need of major overhaul. Interested only in Gipsy Moth, Fleet, Waco Taperwing, F or F-2, Lambert Monocoupe, Aeromarine Klemm or similar, and Taylor Cubs. Continental Airways, Newark, Airport, Newark, New Jersey.

WANTED: Late 1933 or 1934 Waco C or Stinson, must be in excellent shape. Have Inland Sport Warner to trade on it. Give full details and lowest cash difference in first letter. S. D. Marrett, Jr., Navasota, Texas.

WANTED: Waco F, Monocoupe or similar ship. State all first letter. Time, place, lowest cash price. Write Bert Iten, Fort Ripley, Minnesota.

WANTED: Kinner K-5 center motor mount for Kreutzer or Air Transport. Apartado 38, Parral, Chihuahua, Mexico.

WANTED: We pay cash for used or cracked-up wings in any condition. Aircraft Reconstruction Company, Northbrook, Illinois.

CASH FOR J-6: Any model; two J-5's, Warner and Lambert motors, also parts for same. Give complete details, prices, etc., in first letter. AERO DIGEST, Box 1954.

WILL PAY CASH: For airplanes, engines or parts in any condition. Write complete details, prices, etc., in first letter. J. E. Poission, 1219 Penn St., Grand Rapids, Michigan.

WANTED: Lambert 90 engine, speed ring, steel propeller for Lambert, Warner and Kinner. Also want Spad, SE-5 or other wartime pursuit ships. P. O. Box 1457, Tampa, Florida.

$400 CASH: For used two or three-place plane. Aeronca C-3 or good licensed ship with over 50 horsepower. William Hinde, Huron, Ohio.

WANTED: Szekely engine, SR-O, 45 h.p.; or will buy prop hub, set connecting rods complete for engine above, No. 1062. Harris, 726 Day Ave., S. W., Roanoke, Virginia.

WANT GOOD AERIAL CAMERA complete, or equivalent value in other aviation instruments, radio, etc. Will give in exchange Buick 8-cylinder sedan, 1932, 18,000 miles, 6 wheels, motor perfect condition, upholstery always kept covered. Going abroad; trade must be made first week January. Room 3207, 80 Broad, New York. Phone: BO-9-0135.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

GENUINE LEATHER fur-lined flying suit, moccasins and gloves. Medium size. Excellent condition, worn only a few times. Bargain, $75. Mrs. Montrose Tull, Chapel Hill, North Carolina.

WAR RELICS for clubhouse or den. Vickers aircraft machine guns; cost government $700; rendered unserviceable without marring. Only $7.75 each. Sent C.O.D. on payment of $1. Weight 33 pounds. Fiala Outfits, 47 Warren Street, New York, N. Y.

DON'T BUY ANYTHING until you get Ort's 1934 Aviation Material Catalog. Prices are lower. Send one thin dime today. Karl Ort, 619 W. Poplar St., York, Pennsylvania.

FOR SALE: OX Robin, air wheels, Scintilla and many extras; beautiful finish. Terms. Earl Walker, Sullivan, Illinois.

LYCOMING ENGINE PARTS at a bargain. Stinson SMSA, also 1933 Reliant; Wasp all-metal Flamingo; low-wing Spartan Trainer. 4-place 300 h.p. Spartan Cabin, like new; Curtiss, Jr.; OX Robin. New and used instruments, generators and control boxes. Large supply of plain and corrugated sheet dural and aluminum. Also sheet steel, tubing and angles. The Vermilya-Huffman Co., Lunken Airport, Cincinnati, Ohio.

EDO FLOATS in good condition, $350. Model No. 1835 for Fleet or similar ship. E. Closs, Sparta, New Jersey.

KINNER K complete front exhaust, $200. Curtiss D-12, fine shape, $300. Best offer on 6 OX motors and large lot of new and used spares. Hand crank for Kinner, $10. Nose cowling for Fleet, $10. Liberty, Hisso, Hall-Scott motors and parts. Tachometer heads, $5. Altimeters, $3. Century-Cyclone and Ludington outboard step-boats, new, $35 up. 26-foot Hacker design mahogany speed boat, 55 m.p.h., like new, $600. Coast Guard Picket Boat, 35 foot, 200 h.p., Speedway motor, fast, $800. Privateer Amphibion, Warner motor, fine shape, licensed, $1,000. Deluxe Warner Fleet, Edo modern floats, rudders, Heywood, trunk, landing gear with brakes, A-1, licensed, $2,200. Deluxe Chris-Craft, like new sedan body, 250 h.p. Chris-Smith motor, 45 m.p.h., Luxe fire system, cost $6,500; sale price, $3,500. Essington Seaplane Base, Essington, Pennsylvania.

TAYLOR CUB CRACKUP: Twenty hours on ship. Aeromarine motor, slightly damaged. Tall surface, landing gear, good condition. Fuselage, wings badly damaged. $500. Mrs. Montrose Tull, Chapel Hill, North Carolina.

ENGINE PARTS: Curtiss Challenger main case and other parts, off. J-5 main case, crankshaft and other parts, off. All Velie M-5 parts. Warner Scarab intake, housing, NAR-5A carburetor, Scintilla mags, induction, gear housing and gears, crankshaft, master rod, thrust bearings and front case cover. J-5 steel prop hub or complete propeller. 45 h.p. Szekely crankcase, crankshaft, rods, mags, cam lifters, etc. Dunaway Garage, 2201 Indiana Ave., Kansas City, Missouri.

FOR SALE: B-5 Ryan wing, covered like new, $300. OX-5 motors and parts, cheap. Wanted: J-6 Ford trimotor. Roger Mensing, 1218 Jones Street, Fort Wayne, Indiana.

FOR SALE: Winter enclosure for Aeronca Collegian. Practically new. Set of 7x4 airwheels, complete. Write to D. W. Franklin, 79th St. and Northern Boulevard, Jackson Heights, N. Y.

SHIPS AND PARTS for sale: OX-5 Robin, $550. Curtiss Jr., NC-10904. Lincoln Page, NC license, never cracked, $250. Control surfaces and a few other parts for C-3-B Stearman. Also covered steel fuselage with motor and prop, ideal for ice boat, $35. Jack Lysdale, Mankato, Minnesota.

SET EDO DE LUXE floats: Waco F or similar ship, perfect condition; no reasonable cash offer refused. E-4000 Travel Air, full night flying equipment, electric starter, etc., $1,100. Hawthorne Flying Service, Charleston, S. C.

TRAVEL AIR 2000 radiator, cowling and mount for Tank engine. New Berling magneto, $25. OX Scintilla with gear box, $25. Waco 10 left upper wing, upper ailerons. General Air Service, 4500 W. 83rd St., Chicago, Illinois.

WACO TEN WINGS and parts. Waco F-2 center section and right upper. Lockheed parts. Eaglerock parts. Low prices on repairing or rebuilding. Charley Raudahaugh, 13210 French Road, Detroit, Michigan.

Classified Advertising

RATES * CLOSING DATE * PAYMENT

THERE is a minimum charge of $2.50 for classified advertising in AERO DIGEST, which permits the use of twenty-five words including name and address. For more than twenty-five words, the cost is ten cents per word. Classified copy is payable by check or money order, in advance of publication.

Initials, model numbers, street numbers, etc., count one word. For instance: T. N. Smith, three words . . . or Wright J6-9, two words . . . or 446 Eighth Avenue, three words.

The following sample advertisement will serve as a guide for wording and counting your own advertisements—

"FOR SALE: Waco Cabin, like new, Continental 210 h.p. engine,
1 2 3 4 5 6 7 8 9 10
165 hours, licensed until October 1934. Equipment includes turn and
11 12 13 14 15 16 17 18 19 20
bank, compass, fuel gauges, flares, cowl, pants. Will sacrifice for
21 22 23 24 25 26 27 28 29 30
$1,800. Write or wire John P. Jones, 123 Smith St., Brownsville, Texas."
31 32 33 34 35 36 37 38 39 40 41 42

Forty-two words; this advertisement would cost $4.20.

Forms for classified advertising in the February AERO DIGEST will close January 23rd.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

HEYWOOD STARTER: For Continental engine; factory overhauled and complete with tank, $95. Pair of wheel pants for Waco F-2, $40. Wings Corporation of Philadelphia, Ambler, Penna.

LYCOMING MOTOR; cracked-up J6-9 Laird; Fairchild parts; radio shielding for Lycomings; Westport radio. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

KINNER (late type) parts: slightly used, for K-5; 50% off list. Complete inventory. Also used ship bargains. The Walz Corporation, Central Airport, Camden, New Jersey.

"FLIGHTEX" wing covers: Waco, Travel Air, etc., $10. Fuselage covers, $12; others proportionately. Licensed cable splicing. OX-5 parts. Jet wrenches, 15c. Ostergaard Aircraft, Parr, Indiana.

BRAND NEW Fahrenheit temperature gauges, 12-foot tubes, $1.90. Crawford Airplane Supply Co., Venice, California.

ENGINE, AIRPLANE SURPLUS PARTS: For Waco, Bird, Travel Air, Fleet; Warner, Continental, Wright motor parts. Write or wire us your needs. Waco Sales of New York, Inc., Hangar 16, Roosevelt Field, Mineola, New York.

J-5 AMERICAN EAGLE: $440. What will you give for 129 model licensable American Eagle parts? Good used Kinner K-5 parts: Heads, 19-, 16- and 12-stud side exhaust, $8.75. Head assemblies, $12; cylinders, $5; crankcase, $30; shaft, $30; cam follower assemblies, $1.75. Excellent Scintilla Magnetos, $15. 28 x 4 tires, $1.50. OX-5 Miller set, $30. OX-5 parts reasonable. Renfro Airport, Hereford, Texas.

SELL CHEAP: Delta equipment. OX-5 Waco 10. OXX-6 Waco 10. Material, parts and motor to rebuild Waco 10. Can license all. C. M. Hyde, Box 906, Schenectady, New York.

PROPELLERS: Lowest prices in the country. Steel props for J-6, J-5. A few brand new Hamilton wood props at $15. We stock Flottorp, Marshall and Bennett propellers for all motors. Central Air Service, Grand Rapids, Michigan.

AIRPLANE PARTS: Monocoupe Velie ailerons, Waco 10 parts, Great Lakes parts. Dunaway Garage, 2201 Indiana Avenue, Kansas City, Missouri.

POSITIONS WANTED

YOUNG MAN: 22, desires position in commercial aviation. Progressive, ambitious, two years college, five years retail sales experience, twelve hours flying time. At present taking evening school air transportation. References. AERO DIGEST, Box 1942.

YOUNG MAN: 29, married. Former pilot and airport manager. Not actively engaged in aviation for past 4 years, but keenly interested. Executive ability and personality assured. Interested and understand merchandising, exploitation and promotion. Need a few check flights to license. Willing worker and anxious to re-establish myself in the industry. Not interested in a soft job, but something worthwhile and with a future. Would like to connect with a live wire organization, connected directly or indirectly with aviation. Free to travel. I have the ability and ambition—what have you to offer me? Write AERO DIGEST, Box 1948.

TRANSPORT PILOT, 28, single. Six years flying. With or without late model licensed plane. Good references. Clean record. Reasonable wages expected. AERO DIGEST, Box 1946.

YOUNG MAN: 26, single. Desires permanent connection with future in aviation industry. Over five years flying, maintenance and field management. Excellent reference. Go anywhere. AERO DIGEST, Box 1947.

TRANSPORT PILOT, 20, single. Well educated. Experienced night, cross country, radio beam and blind flying. Graduate Spartan School of Aeronautics. Prefer private party or company. Flying at present. Make me a proposition. Best references. W. H. Bowerman, Jr., Memphis, Texas.

PUT THIS EXPERIENCE to work for you: S.A.T. rating; Class II, III ratings; licensed Mexico, South America; 15 years experience—airline, test, racing, instruction; 5,200 hours; 2,000 on boats, pontoons. Speak Spanish, Portuguese. Have flown in Asia, Africa. Will consider position any part of world. AERO DIGEST, Box 1961.

HELP WANTED

WANTED: Mechanics and Engineering instructors, by a large recognized school. Give experience in detail. Replies held confidential. Write AERO DIGEST, Box 1953.

PARACHUTE JUMPER WANTED: Male or female. Preferably with own equipment. Going south. State your proposition immediately. Will consider buying trainer outfit. John Osterhouse, Mandan, North Dakota.

SEVERAL ENGINEERS and draftsmen with experience on large flying boats. Give age, training, experience, salary expected, present employment and when available. AERO DIGEST, Box 1960.

PARACHUTES FOR SALE

PARACHUTES: Approved types, bought, sold, exchanged, repaired, packed, rented. Specify fully requirements. Airports should investigate drawing power of balloon and inexpensive operation for Sunday business. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

IRVING white silk seat pack chute; 24 foot; in perfect condition. $100. Might trade on inverted Cirrus or Gipsy engine in good condition. Edward H. Johnson, 64 Grand St., Springfield, Massachusetts.

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"The World's Best Books on Aeronautics"

A PILOT'S TRAINING GUIDE:

Practical Flying

by **Major B. Q. Jones,** *Air Corps, U. S. Army; formerly Chief, Aviation Training, A.E.F.* **$3.00.**

This famous pilot's manual can save you hours of time and a lot of money in your flying training. Reading this book is like having at your elbow the famous flyer who wrote it ready to clear up quickly all the scores of questions that puzzle you as you progress to the skill of an expert pilot. It gives you the basic facts that otherwise you would have to learn from long and costly experience. Major Jones provides clear and concise answers to the hundreds of questions that student pilots have asked for years—information that is essential for a proper understanding of piloting. For much of the detailed information the material is prepared in question and answer form. A variety of practical subjects is covered such as taxying, the take-off, the initial climb, emergency landings after the take-off, straightaway flight, turns, figures-of-eight, glides, landings, cross-country flying, stalls and spins, etc. The book is packed with useful facts on planes, instruments, technical expressions, plane parts, pilot's equipment, methods of plane inspection, testing controls and motor.

PREPARES FOR ANY LICENSE TESTS.

Aeronautics

by **Hilton F. Lusk,** *formerly Dean, Boeing School of Aeronautics.* 175 *illustrations.* **$3.25.**

This is a complete ground school course in handy book form. It clearly and thoroughly explains all the subjects you need to understand to pass the written part of the government examinations for a license as an airplane pilot in any of the grades—including transport pilot, or as an airplane or engine mechanic. No one who masters this book will have any difficulty in answering any question that may be asked in the license examination. 224 test questions help you test your grasp of each subject. It is so clearly and simply written that you will have no trouble in grasping its explanations even if you must study at home without the aid of an instructor. One entire chapter is devoted to a description of 125 occupations in the aeronautic industry. The 15 chapters explain just what you need to know about Flight Principles; Airplane Construction, Operation; Engine Principles, Construction, Operation; Propellers; Blind Flying and Engine Instruments; Maps; Piloting; Dead Reckoning; Avigation Instruments, Equipment; Meteorology.

INTRODUCTION TO AIRPLANE DESIGN:

Elements of Aviation

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A simple explanation of the principles of flight and of elementary airplane design, telling just what an airplane does and why it does it. The book covers the fundamentals of aerodynamics by simple, easily understood comparisons; laws of motion and their application in aeronautics; air forces; lift and drag; airflow over various surfaces; effects of airflow; stability and control; propeller effects; slipstream, etc.; effects of altitude; parts of an airplane; weights and dimensions, etc.

USED BY FAMOUS DESIGNERS:

Engineering Aerodynamics

by **Lieut. Cmdr. Walter S. Diehl,** (*C. C.*) *U. S. Navy, Scientific Section, Bureau of Aeronautics.* 159 *illustrations.* **$7.00.**

In this book America's outstanding authority covers modern hydrodynamic theory and its practical applications, including stream function, velocity potential, circulation vortex theory, induction theory, etc. Test data on standard wing sections, ailerons, streamlining, etc., are included with working diagrams and equations, and detailed instructions for their use. Shows how to interpret model test data, gives methods for designing control surfaces, and for rapid performance estimation.

A COMPLETE ENGINE COURSE:

Aircraft Engine Mechanics Manual

by **C. J. Moors,** *Chief Instructor, Department of Mechanics, Air Corps Technical School, U. S. Army.* 189 *illustrations.* **$4.50.**

This book covers the same ground as the course given the enlisted mechanics of the Army Air Corps with the addition of much data on types of equipment adapted only for commercial airplanes. It deals thoroughly with all kinds of aircraft engines and their accessories. It explains exactly how they operate and the features in which the various makes of competing equipment resemble each other and those in which they differ. Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making any necessary repairs and adjustments. Photographs, diagrams, and working drawings make it easy for you to follow each explanation.

ESSENTIAL FOR SAFE FLIGHT:

Airplane Mechanics Rigging Handbook

by **R. S. Hartz,** *formerly Lieut. Colonel, Air Corps., U. S. Army; and* **Lieut. E. E. Hall,** *formerly Editor, "Aircraft Servicing."* 104 *illustrations.* **$3.50.**

This book covers in detail the care and handling of airplanes on the ground and in the shop; sequence of rigging steps; how to true up the assembled ship; how to adjust the wings and control surfaces for "hands off" flying; spars and struts; inspection; installing and checking compasses; fabric; wood and glue; metal parts; wire; dopes and doping; folding and packing parachutes. It shows you how to get a plane into proper flying condition and how to keep it that way.

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This famous textbook is used by the Army cadets at West Point and by students in over 100 leading technical schools, colleges, and flying schools. Everywhere recognized as the outstanding technical book in the aeronautic field, no other book approaches this in popularity or is so widely used.

It provides a clear and easily understood explanation of the fundamental aerodynamics involved in the design and operation of the airplane. It shows, for example, how to make the necessary calculations to estimate the performance of a particular plane under various conditions.

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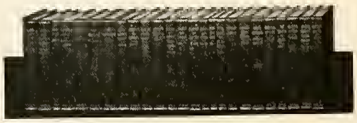

From London to Australia

"THEY PILOTED A REGULAR COMMERCIAL PLANE" ★ ★ ★

One of two Wright "Cyclones" that powered the Commercial Douglas . . . equipped with Thompson valves.

One of two Pratt and Whitney "Wasps" used in the Boeing 247-D...equipped with Thompson valves.

"British aviators, interested in making flying pay for itself, say that the Dutch flyers' American machine, a Douglas air liner with Wright cyclone motors, and the United States Boeing transport plane, in which Roscoe Turner and Clyde Pangborn were trailing for third place, are 'straight stock commercial planes.' The British race winner is a 'bulletlike racer.'

"This doesn't take away from the credit of the plucky Englishmen or diminish in any way their marvelous performance in cutting the flying time from London to Australia by 100 hours. They made the flight to Darwin in 52 hours. But the race does show that private enterprise in the United States is able to build useful commercial planes."

—Arthur Brisbane in "TODAY"

Reprinted from the Hearst Daily Newspapers

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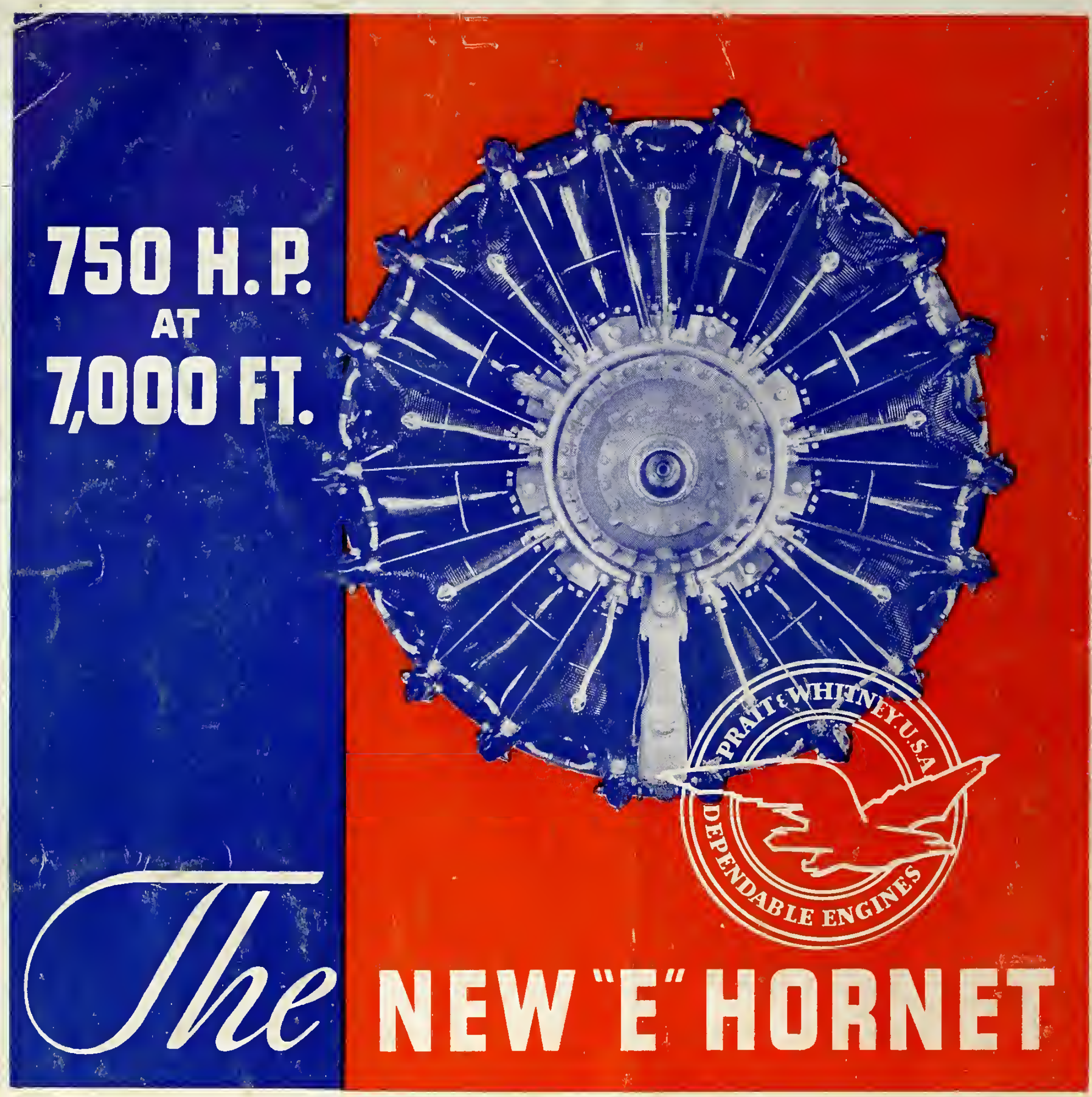
CLEVELAND—DETROIT



Thousands of hours actual flying experience over the past seven years is the proving ground from which has evolved the new Series "E" Hornet. Greater strength and improved design are evident in every part. Automatic valve gear lubrication, priming type carburetor, automatic oil temperature control, and pedestal mounted cam are among the many improvements making this the finest Hornet ever produced. Rated at 750 HP at 7,000 feet by its Department of Commerce Approved Type Certificate Number 136, this new Series "E" Hornet Model S1E-G ranks as the world's most powerful single row radial air-cooled engine available in a production model.

PRATT & WHITNEY AIRCRAFT COMPANY, EAST HARTFORD, CONNECTICUT

SUBSIDIARY OF THE UNITED AIRCRAFT CORPORATION

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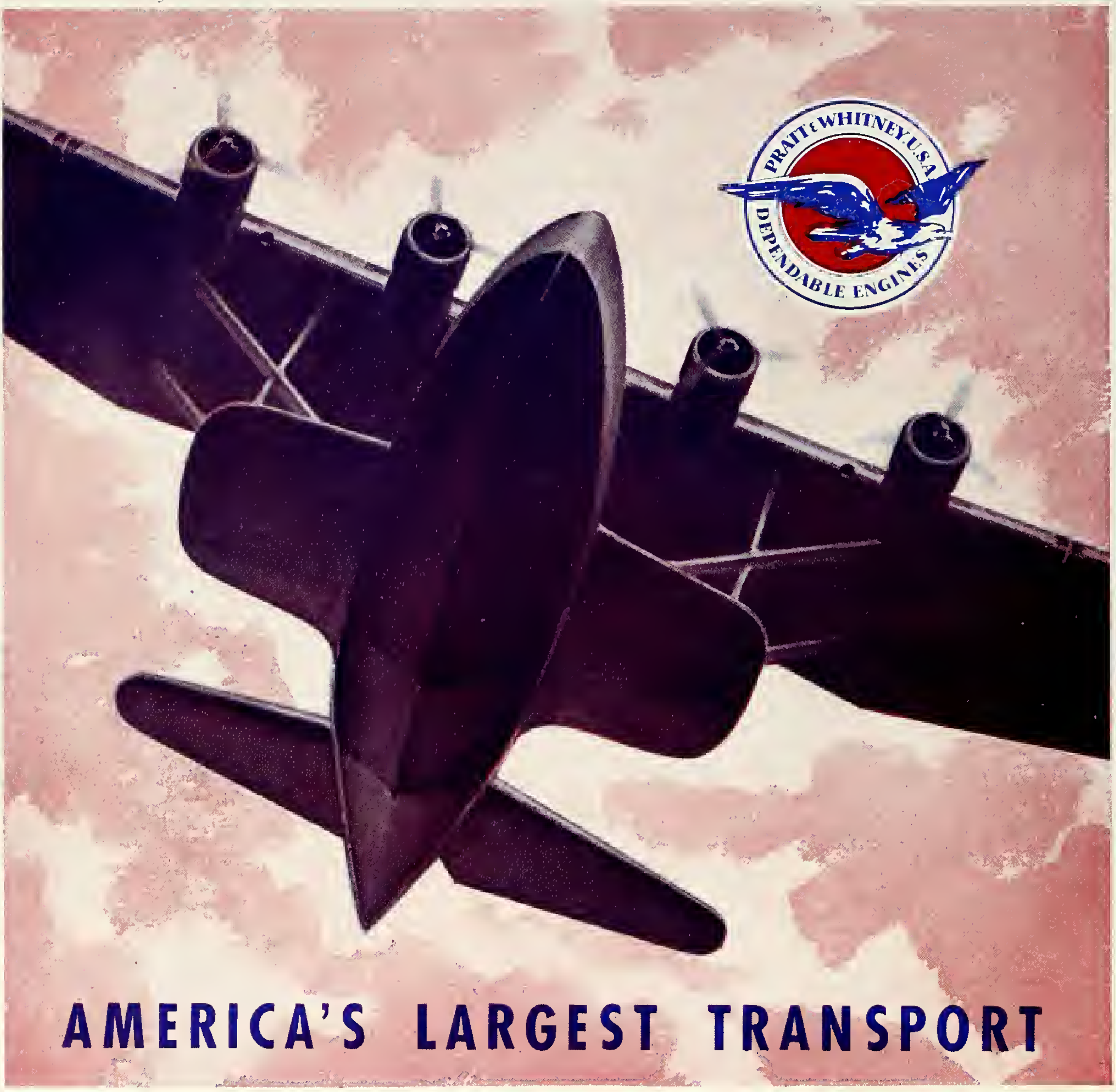
AERO DIGEST

INCLUDING

AVIATION ENGINEERING



POWERED BY FOUR TWIN WASP ENGINES

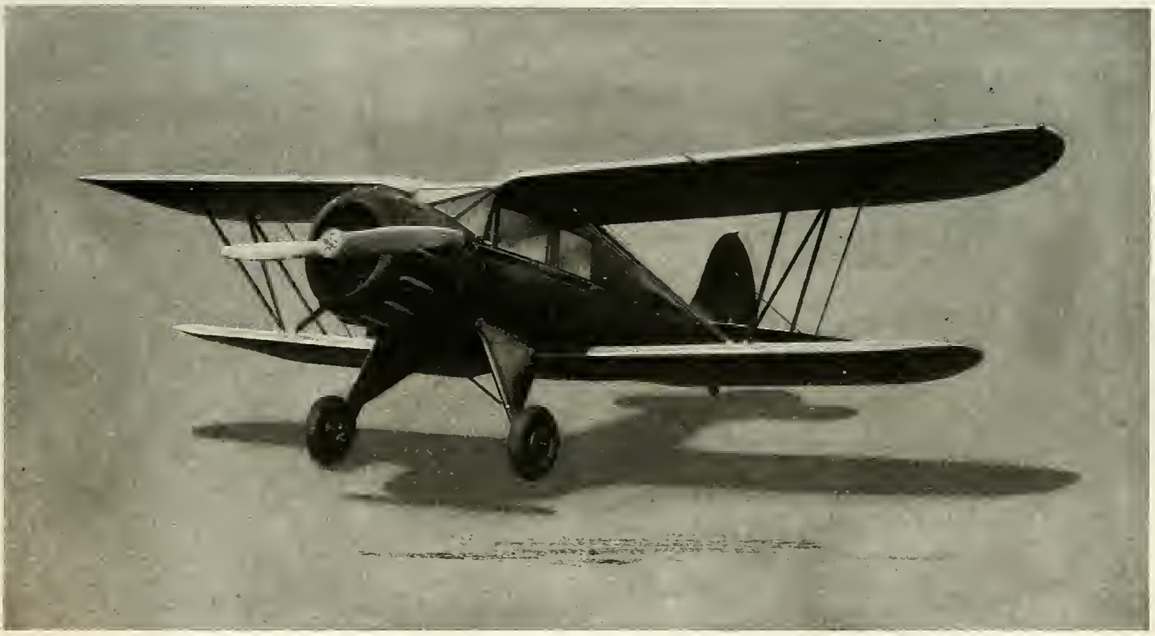
Pan American Airways' latest addition to its fleet of trans-ocean flying boats is the recently completed Martin built "Flying Clipper No. 7." This all-metal, high-wing monoplane has been designed specifically by the Glenn L. Martin Company for use on projected Atlantic and Pacific Ocean routes of Pan American Airways. Four geared and supercharged Twin Wasp engines, rated at 800 h.p. each at 7,000 feet, power this 48-passenger ship. "Flying Clipper No. 7" has a cruising range well in excess of the longest over-water leg on any ocean trade route.

THE PRATT & WHITNEY AIRCRAFT COMPANY, EAST HARTFORD, CONN.
SUBSIDIARY OF UNITED AIRCRAFT CORPORATION

AERO DIGEST, *February, 1935*
Volume 26. Number 2.

Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y., Yearly subscription, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879.

Now a Waco Cabin Plane at $5225.00



Here's a Standard Series four-place cabin WACO that will create a sensation in 1935. A ship with ample power and with performance features that cannot be matched at anywhere near the price. Basically it is similar to the now famous 1934 Cabin WACO. Refinements and changes have made possible new, low prices for this model SC WACO, powered as follows—

SPECIFICATIONS AND GUARANTEED PERFORMANCE

Engine	Horse-power	Ignition	Top Speed	Cruising Speed	Landing Speed	Price
Continental	210	Magneto	140	122	50	$5,225.00
Jacobs	225	Magneto or Battery	144	125	50	5,490.00
Wright	250	Magneto	148	127	52	7 000.00

We suggest that you make arrangements now with your local WACO dealer for a trial flight. It will not obligate you in any way. If you do not know his name, write us.

* * *

In addition to the Standard Series four-place cabin WACO, the 1935 line of WACOS will include a new Custom Series four-place cabin plane which will be announced soon. This ship will embody features which will make it the world's outstanding airplane.

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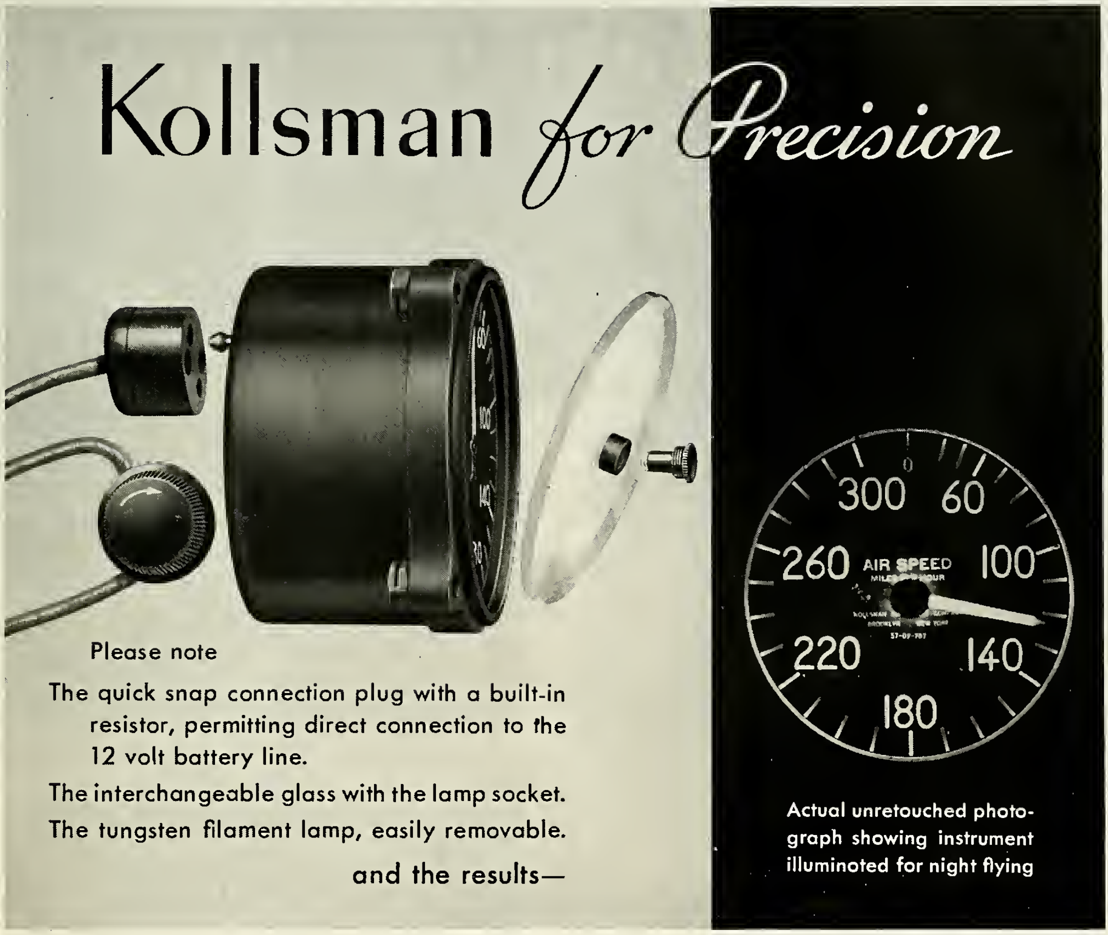

Please note

The quick snap connection plug with a built-in resistor, permitting direct connection to the 12 volt battery line.

The interchangeable glass with the lamp socket.

The tungsten filament lamp, easily removable.

and the results—

Actual unretouched photograph showing instrument illuminated for night flying

THE INSTRUMENTS with the self-contained illumination system, with white incandescent light, to which our eyes are accustomed. Uniform illumination of dials and pointers, with light of variable intensity so that the instruments can be comfortably seen

Flying in the blackest darkness . . . *or* in the twilight
. . . *or* in the glare of the floodlights of the airport

without fatigue to those eyes that must see all that can be seen.

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KOLLSMAN INSTRUMENT COMPANY, 5 JUNIUS STREET, BROOKLYN, NEW YORK

AMERICAN AVIATION ADOPTS

GENERAL *streamline* AIRPLANE TIRES

Left—T. W. A. System's new Douglas airliner equipped with General Streamline Airplane Tires.

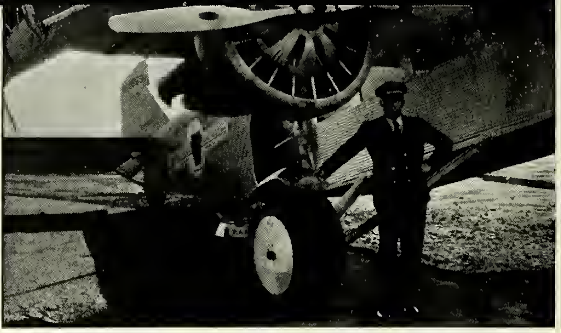
Major James H. Doolittle, Mgr. Aviation Department, Shell Petroleum Corp., uses General Streamline Airplane Tires on the Company's Lockheed Orion.

Col. Roscoe Turner says, "General Streamlines give me better take-off, less air resistance and soft, smooth landing."

General Streamline Airplane Tires reduce parasitic drag of landing gear and wheels—Have higher performance at take-off—Greater ease in ground maneuvering and taxying—reduce ground looping tendencies—prevent porpoising.

FOR INFORMATION WRITE TO:

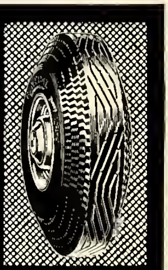
Air Associates, New York, Chicago, Los Angeles.
Bredouw-Hilliard Automotive Service—Kansas City, Mo.
General Tire & Rubber Co.—Aviation Dept., Akron, Ohio.



Pennsylvania Airlines has declared that all its planes will be equipped with General Airplane Tires, following a 400-hour testing period.

Streamline tires are now standard on all new Army Air Corps Planes.

AND *Streamline* JUMBOS FOR YOUR AUTOMOBILE



Built like the Streamline Airplane Tire —wider at the base tapering to a standard width auto tire tread. This streamline design provides stability and easy steering with only 12 to 15 lbs. of air.

GENERAL TIRE & RUBBER COMPANY

AKRON · · · OHIO

AGAIN...AVIATION ASKS FOR PARKS GRADUATES

SIX MORE MEN WERE CALLED FOR WITHIN THREE DAYS . . .

The Parks diploma will open for you too the door of opportunity in aviation as it has for these six men and for hundreds of others.

Five of these men left Parks just recently to take their places in a large aircraft factory.

They were not personally acquainted with their employer, and their employer did not know them. But their employer, like every other employer in aviation, does know Parks Air College. He knows that Parks Air College provides just the training he wants his employees to have, and moreover he knows he can rely absolutely upon the recommendations the College makes to him. Previous experience with Parks graduates has taught him that.

That is why he wrote:

> "We can use three airplane assembly men. Will you pick out for me three of the most reliable men you have for these jobs and send them along?
>
> "If you have an exceedingly good metal cowling man, we can use him too.
>
> "We could also use an electrical man, whose business would be to install in airplanes all the electrical equipment."

Met requirements!

RUSSELL YEDNOROK
McLURE HANCOCK NIELSEN

INTERESTING FACTS ABOUT PARKS AIR COLLEGE

Founded August 1, 1927.
Owns its own airport of 100 acres.
Has 14 buildings with a total floor area of 119,352 square feet (2¾ acres) all devoted to school purposes.
3 dormitories and a cafeteria are operated for Parks students.
Has 9 training planes on the line, ranging from the low-wing Kinner up to the Lockheed Vega.
Offers complete course in radio beam and instrument flying.
Offers three 2-year courses (96 weeks) leading to Bachelor of Science degrees in Aviation Administration; Aeronautical Engineering; Aviation Mechanics.
Faculty of 22 composed of specialists in various fields of aviation.
A total personnel of 42 people.
Enrollment of 201 at beginning of Winter term.
1,232 graduates.
48,000 hours flight experience.
1,406 planes and 395 motors repaired and rebuilt in our shops.
Graduates with every leading aeronautical concern in America and in many foreign countries.

EXECUTIVE GRADUATE WANTED

At about the same time another letter came asking for a transport pilot with executive and mechanical training. His duties would be to meet airplane customers and prospects, demonstrate and deliver planes, make inspections and do line service work.

> "The difficulty we have had in trying to fill this position," this manufacturer explained, "is that most transport pilots have an idea that all they have to do at the hangar is fly a little once in a while. We want somebody who can fly, but whose flying is just incidental to doing a good job running our hangar."

A splendid opportunity, this is, to work directly into a responsible executive position.

Parks Air College is ready to provide you with the education and training you need to fulfill the strict requirements of aviation. More than that, the College will, when you receive your diploma, be ready to help you find your place in the industry.

But it is necessary for you to do your part. Aviation will not wait for you. Neither can the hands of the clock be held back for you. Opportunities which you might have will be secured by another unless you take the initiative.

If you are really in earnest, if you are determined to become a part of aviation, and to advance to a responsible position, you will want to learn, now, all about the opportunities Parks Air College has provided for you.

The coupon on this page will bring this information to you. You may clip it, fill it in and mail. When we receive it, we will promptly mail you our catalog and Outline of Courses. These books will give you the information you desire.

PARKS AIR COLLEGE
WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

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Address ____________________________
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- ☐ Master Mechanics' Flight
- ☐ A. & E. Mechanics'
- ☐ Aeronautical Engineering
- ☐ Limited Commercial Pilots'
- ☐ Aviation Business

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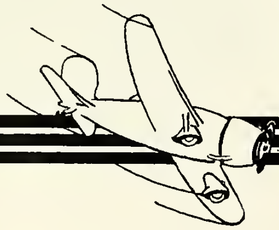
88% of All Winning Planes in the Miami All-American Air Races Were Kendall-Lubricated!



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DALLAS AVIATION SCHOOL AND AIR COLLEGE • LOVE FIELD • DALLAS • TEXAS

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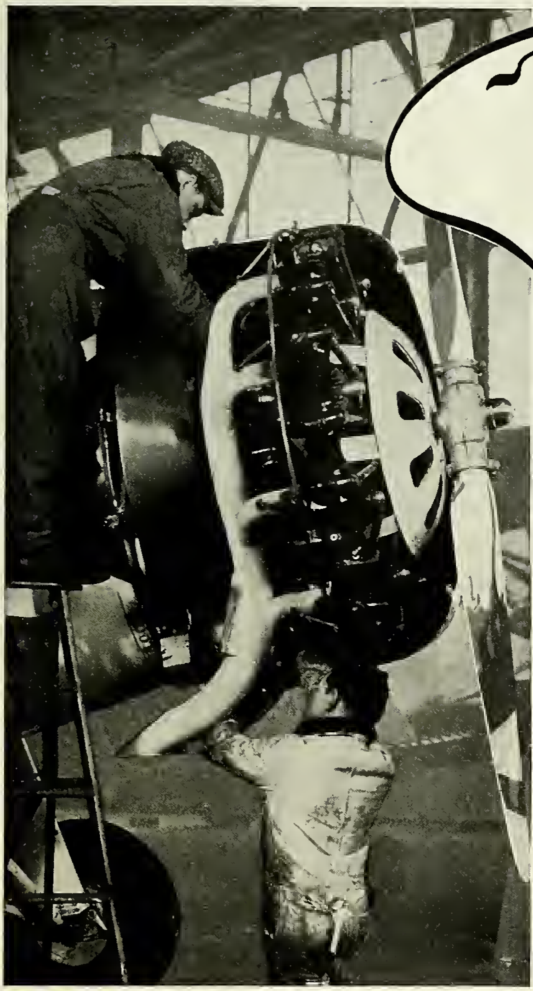
DALLAS AVIATION SCHOOL AND AIR COLLEGE

LOVE FIELD **DALLAS, TEXAS**



Engine overhauling? New Gulfpride Motor Oil cuts these to a minimum!

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GULF takes another important step to give ideal lubrication to the aviation industry . . . . .

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1. Toughest lubricating film.
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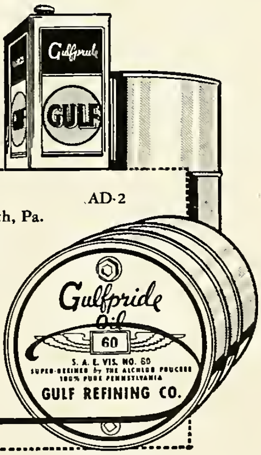
5. Quicker starting.
6. Most efficient under all operating temperatures.

The new Gulfpride is sold in handy 5-gallon cans and 50-gallon drums.



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Address ....

Look for the famous Gulf Indicia on Gulfpride Oil Containers

GULF

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BUSINESS MAN'S—BELLANCA SKYROCKET PACES FAST AIR LINER ACROSS NATION

My Bellanca Skyrocket is the ideal all around ship for business and pleasure flying.
F. W. Fuller Jr.

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When a stock plane, privately owned and flown, on a purely business trip, duplicates the trans-continental schedule of a modern air line — **that's news!** And that is what Mr. Frank Fuller, Jr., of San Francisco recently accomplished in his Bellanca Senior Skyrocket. Taking off from Newark, N. J., he calmly set his plane down at San Francisco—flying time only nineteen hours—perfect performance all the way. No wonder he and many other business men confidently go where they want to go in Bellanca Skyrockets. These ships have proved that they are fast and dependable under all conditions.

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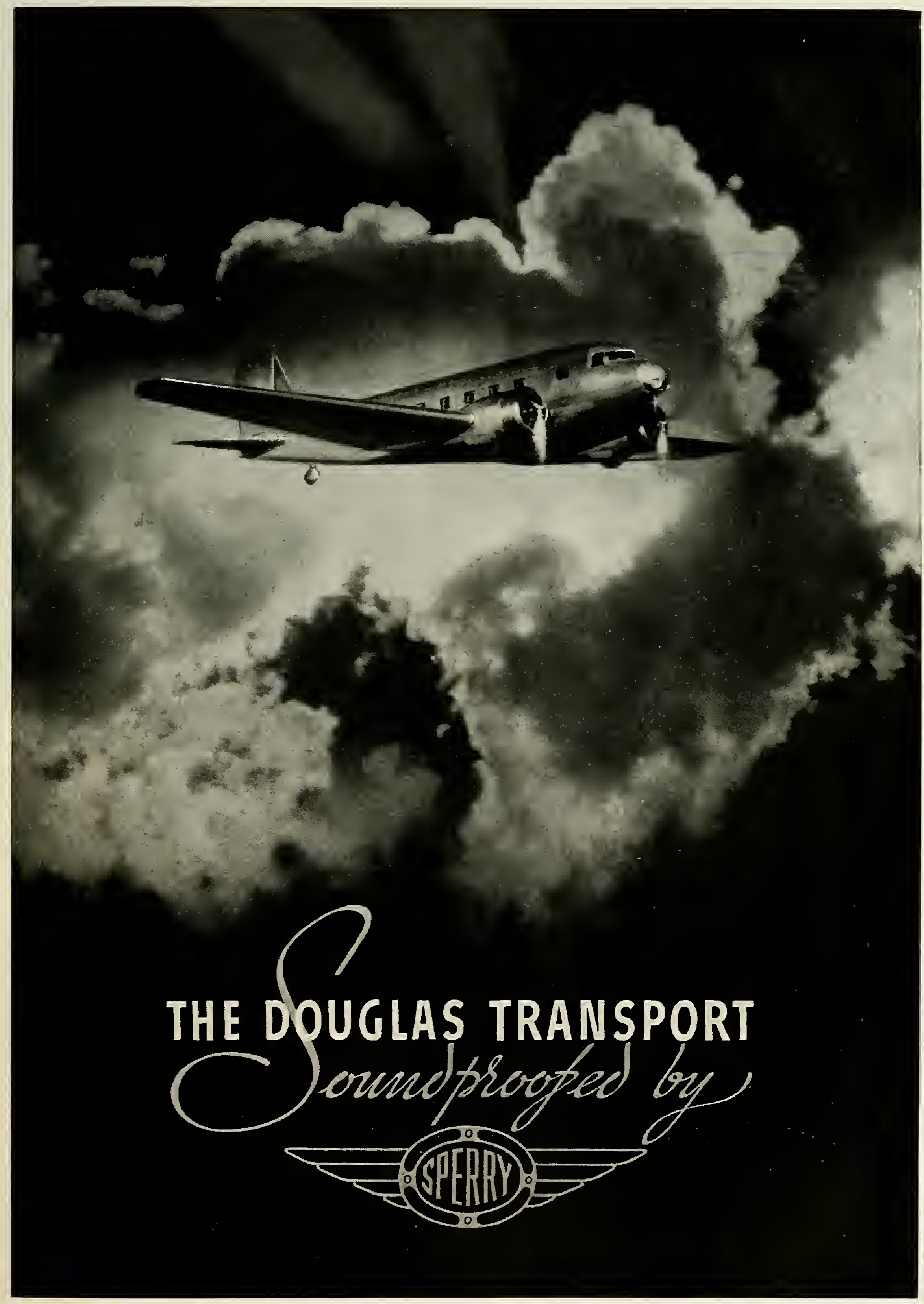
THE DOUGLAS TRANSPORT
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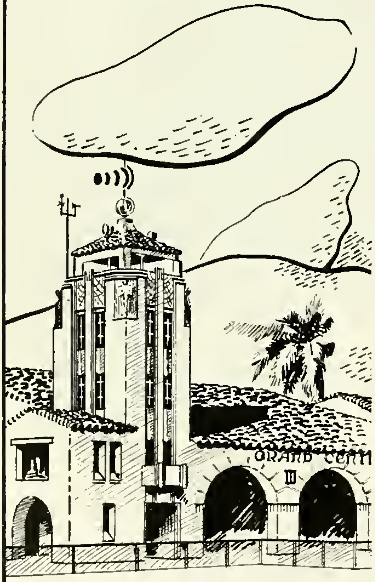

Curtiss-Wright Technical Institute is a conservative educational institution. We never have, and never will guarantee employment to our graduates. No reputable school could, although we have always made it a policy to assist worthy graduates in obtaining employment.

But—

We honestly believe that every student who enrolls here before the summer of 1935, will be able to obtain, with our assistance, IMMEDIATE employment upon graduation, ten months or a year hence. This is not a promise.

But—

Here is why we are so CERTAIN this will be true. EVERY aircraft factory in Los Angeles—DOUGLAS, NORTHROP, VULTEE, LOCKHEED, etc.—is BURSTING with new and unfilled orders. We predict PEAK employment during the spring and summer of 1936. All the manufacturers are now enlarging their plants and facilities. We are in close DAILY touch with the industry here and we KNOW whereof we speak. TREMENDOUS plans are being made for capacity production. THIS MEANS TRAINED MEN WILL BE IN DEMAND AND AT A PREMIUM. Aviation is a highly specialized business and there is NO CHANCE for employment for the untrained man.

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Our enrollment is LIMITED so get busy at once. DON'T DELAY OR YOU WILL "MISS THE BOAT." You may start at any time. Guarantee your enrollment by sending a POST OFFICE MONEY ORDER for $10.00 today. If it arrives too late we will refund your money.

THIS NOTICE CALLS FOR IMMEDIATE ACTION!

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Under personal supervision of MAJOR C. C. MOSELEY, President.

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Careful and individual attention will be given any inquiry you desire to make regarding our school. Our 1935 catalog and prospectus will gladly be furnished upon request to anyone seriously interested in making AVIATION HIS CAREER by mailing this coupon today.

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SPECIAL ANNOUNCEMENT

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THE KRUESI RADIO COMPASS is a compact, easily operated navigation instrument, "homing" device, and position finder which will work from commercial broadcast stations, all radio beacons, and other government airway stations. It enables the pilot, by the simple operation of keeping an indicator pointer centered, to fly *directly* to any station selected. This reduces aerial navigation, especially when flying blind, to its simplest form.

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THE KRUESI RADIO COMPASS, now available for the first time for general uses, embodies refinements and design features made especially to meet the requirements of every type of commercial and private flying.

THE KRUESI RADIO COMPASS has been in service use by the United States Army Air Corps and is the only radio compass proved by actual experience under severest service conditions of every nature to be entirely dependable in operation. Thousands of fully blind landings have been made with this instrument.

THE KRUESI RADIO COMPASS is built with the benefits of Fairchild's years of experience in high precision manufacturing and in accordance with the same high standards which have always characterized Fairchild aerial cameras and instruments and has made them popular equipment with aviation units and commercial companies throughout the world.

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PURCHASERS OF THIS TYPE OF EQUIPMENT should distinguish between products which are proven by actual service experience and those which are merely experimental.

THE KRUESI RADIO COMPASS is the radio compass adopted as standard by the United States Army Air Corps. Fairchild Aerial Camera Corporation is the sole licensee under the new Kruesi patents (pending).

A product of the

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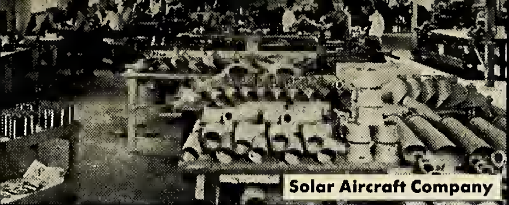
WORLD RECORD

Coast Guardsman Sets Amphibion Speed Record

LIEUT. COMDR. E. F. Stone of the U. S. Coast Guard flew a Grumman amphibion powered by a Wright Cyclone engine over a course at Grand View on Chesapeake Bay at an average speed of 191.796 miles an hour, to set a new world's record for that type of plane. The best time made during the flight was 196.89 miles an hour. The former record was 177 miles an hour. DEC. 20

GRUMMAN AIRCRAFT ENGINEERING CORPORATION
FARMINGDALE LONG ISLAND NEW YORK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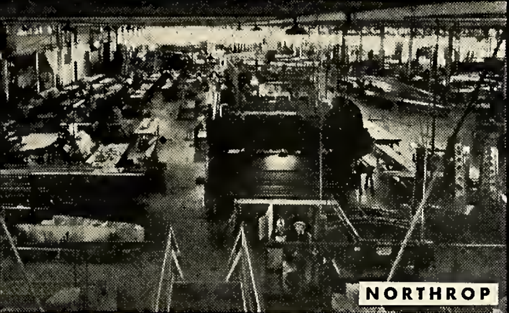
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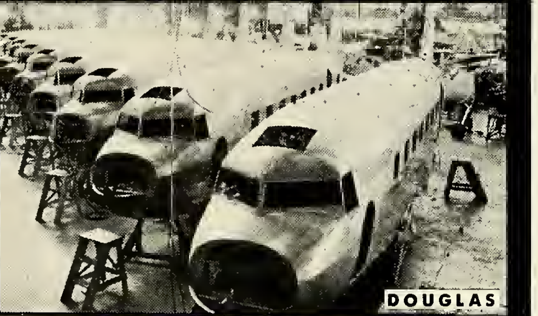
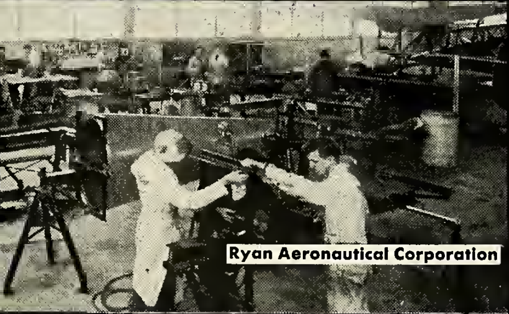

DOUGLAS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A New and Better
Master Mechanics' Course

★ To meet requirements of the largest aircraft manufacturers in the United States, a new Ryan Mechanics' Course offers a complete combination of theoretical and practical instruction with one entire year of closely supervised instruction and actual training in modern factory methods.

Ryan's Mechanic Students are trained in the heart of the industry

Southern California is the heart of the aircraft manufacturing industry.... $20,000,000 worth of airplanes were built here last year. If you want a profession in which there is a real demand for trained men, you should study aircraft manufacture. If you want the best of such training, come where airplanes are being built.

The Ryan School's location in sunny San Diego, within 60 minutes of more airplanes, more airplane manufacturing and more commercial and military flying activity than any other aviation school, offers special advantages to students who want a sound foundation for success in the industry.

Across San Diego Bay, one mile from the Ryan School, is North Island—the Government's largest aeronautical base—with some of the world's largest airplane and engine repair and maintenance shops where more than 400 planes are overhauled and serviced by both civilian and military workers. Within 60 minutes of Ryan are the factories of Douglas, Lockheed, Northrop, Kinner, Menasco, Vultee and Solar as well as the terminals of six major airlines. Directly adjacent is the factory of the Ryan Aeronautical Company, with which this school is affiliated. Specially conducted trips for Ryan students through these world famous aircraft plants is one of the extra curricula advantages of this course.

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Through special arrangement, Ryan students in this Master Mechanics' Course who successfully complete the first 9 months of study, will spend the last 3 months of instruction as student-employees in a modern airplane factory. Ryan student-mechanics in this way will receive the most valuable experience possible in actual aircraft manufacturing and, at the same time, **will be paid for their services.**

This course is approved by aircraft manufacturers who are cooperating with the Ryan School to produce a source of supply of better trained employees. **Ninety-two percent of the graduates of Ryan mechanics' courses during the past six months have been placed in positions in the industry.**

COURSE BEGINS APRIL FIRST. Send the coupon today for your copy of our 40-page catalog with a special folder on this New Ryan Master Mechanics Course. Enrollments are now being made for the next mechanics class which starts April 1st. Training can be started at once in any of the regular Ryan Government Approved flight courses.

Airplane Dev. Co. (Vultee)

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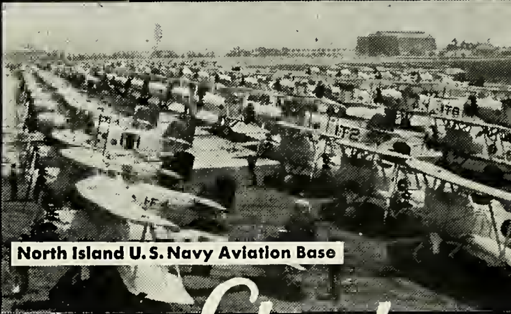
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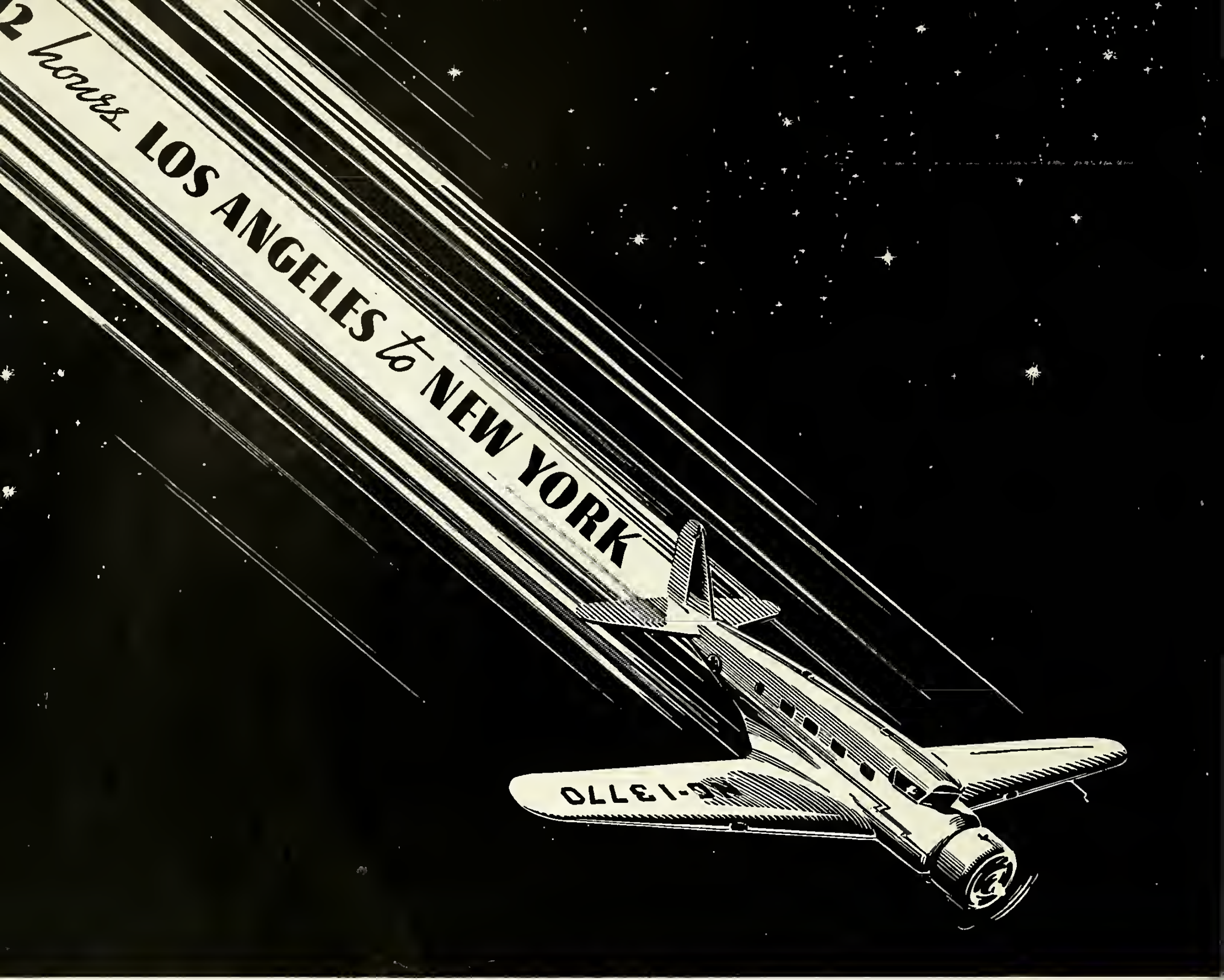
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VULTEE V-1A TRANSPORTS
Powered by
WRIGHT CYCLONES

The new 10-place Airplane Development Corporation's Vultee V-1A Transports, powered by Wright Cyclone Engines, have a high speed of 235 miles per hour and a cruising speed of 215 m.p.h. Super-speed transports of this type are now operated by American Airlines and other prominent air transport operators.

STREAKING through the night at an average speed of 223 miles per hour, Major James Doolittle made a non-stop flight from Los Angeles to New York, in a Cyclone-powered Vultee 10-place American Airlines transport, in 11 hours and 59 minutes—establishing a new transcontinental speed record for transport planes.

New transport speed records were also established during January, 1935, by Eastern Air Lines and Transcontinental & Western Air. E.A.L. made a scheduled flight from Miami to New York in 6 hours and 34 minutes with a Cyclone-powered Douglas. T.W.A. flashed between Chicago and New York, with a Cyclone-powered Douglas in the remarkable time of 2 hours and 54 minutes.

Such outstanding achievements in the field of high-speed transportation speak eloquently of the tremendous power and dependability of Wright Cyclone Engines.

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AERONAUTICAL CORPORATION
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AERO DIGEST

VOLUME TWENTY-SIX NUMBER TWO

COVER DESIGN

Wright Cyclone-powered Curtiss-Wright Condor Arranged for Carrying Troops or Cargo

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A United Airlines' Boeing Transport makes a brief stop for fuel at one of its regular ports of call along the transcontinental skyway

AIR

Hot and Otherwise

FRANK A. TICHENOR

● The Report of the Federal Aviation Commission has at last been published. In the brief interval before going to press, we have had an opportunity to give its 254 pages only a hasty examination. That is not sufficient to discover all the pitfalls that may lie hidden among its recommendations, but it is enough to reveal that, in the main, it is a conservative yet constructive document.

There are no radical departures from traditional aeronautical practices of the past—except where the Jobmaster General's peculiar brand of practices are concerned. Still the report recognizes that, in some instances, there may eventually be a need for such departures and therefore recommends measures to prepare the ground for them. In the matter of carrying all first-class mail by air, for instance, the Commission refuses to go the whole hog by asking for such a drastic change, because it believes this move would at present play havoc with postal appropriations; but it predicts that the day is not far off when it will be feasible and economical for the Post Office Department to despatch its first-class matter by airplane and accordingly has recommended a new air mail set-up which in many ways paves the way. Meanwhile, the Commission suggests that the Government try carrying 2-cent postcards and 3-cent airgrams to increase the volume of air mail. For years, Aero Digest has been urging the Government to take steps toward putting first-class mail on the airlines, but this is the first time the logic of such a move has been able to break through the hard shells of Post Office die-hards.

The Air Transport section of the Commission's manifesto will probably stir up the widest interest on the part of both the public in general and the aviation industry in particular. Although carefully couched in language to save the Administration's face, this part of the report is a ripping rebuke to Fix-'em-up Farley. With some adroit sidestepping of any mention of air mail cancellation or the Jobmaster General's subsequent Dirty Deal to the airlines, the Commission states in terms which cannot be misunderstood that, if that deal is continued, "financial disaster is in the making for a large part of the present air transport system."

We could admire the Commission more if it had come right out and said that the Mix-'em-up-master General's shuffle was a terrible mistake; but then that would have marred the Administration's 100 per cent record—it has yet to do as it promised and admit it has made a mistake of any kind. Nevertheless we don't think the public is going to misconstrue the strong implications of the Commission's words when it says, "The attempt to allocate the right to run lines through a process of competitive bidding is to throw undue emphasis on economy at the expense of quality" . . . and . . . "the air transport map cannot be redrawn every few years without utterly disastrous effect on the service."

The air mail plan recommended by the Commission appeals to us as a reasonable one—provided it is administered honestly and impartially. There is, however, a very definite danger that it will not be. Even now rumors are afloat that the Administration intends to sink the permanent Air Commerce Commission into the obscurity of an over-all transport department as soon as possible. If that happens, woe unto air transport! Political pressure from other transport interests—which little understand and little sympathize with the special problems of air carriers—will crowd the airlines into ruin. No, the whole success, the entire feasibility of the program the Commission suggests in its report depends upon its being put into effect by a group of men whose knowledge of this special problem and whose intellectual honesty cannot be questioned. Anything less means chaos far worse than that we have just been through.

Indeed, we are getting a sample right now of the jumble into which a group of non-aeronautical men could throw the air mail situation even in spite of the best of intentions. The Bureau of Air Mail of the Interstate Commerce Commission has just drafted a set of recommended air mail rate revisions which, in all probability, it regards as fair and just. But what would be the effect of these revisions if put into force? The airlines offering the highest standard of mail, passenger and express service would be heavily penalized and those operating with the poorest equipment and ground organization would be rewarded. Moreover, any and all airlines so foolish as to increase their schedules and extend their mileage—obvious assets to the flying public—would suffer by having their mail rates reduced one cent for each 10 per cent increase in mileage. These things, we say, are the work of well-intentioned men, but men who are stabbing in the dark.

Therefore, in the final analysis, the burden of proof as to the validity of the Federal Aviation Commission's air mail recommendations rests squarely with the Administration. If the President is wise in his selection of members of the permanent air commission, if he has the intelligence to give it the time and the freedom to establish precedents and devise a workable formula for Government assistance to air carriers, then the Commission's program has every reasonable chance to be successful. BUT if he submerges it too soon in the I.C.C. or a general transport division of the Government, he will soon find himself waist deep in another air mail mire.

* * *

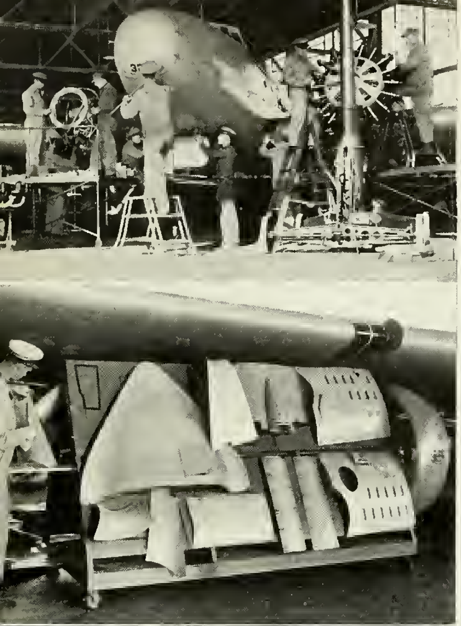
In respect to airports, the Commission hit a foul ball and thereby missed a chance to do aviation a great service. In our hurried perusal of the report, we found this the only instance where the Commission apparently deliberately dodged the issue. By a process of elaborate rationalization, it tried to prove that landing places are not a Government responsibility in the same sense as waterways because harbors and waterways do not involve the acquisition of land as airports do. What the Commission carefully avoided mentioning is that highways are accepted as a public responsibility—shared by Federal, State and local governments—and that highways *do* involve the acquisition of land, far more of it, in fact, than airfields ever would.

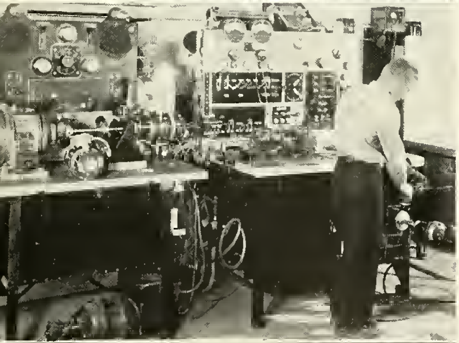
* * *

The Commission's recommendations in respect to the Army and Navy air services are, in general, quite commendable. Once more, the report avoids the extreme of asking for a single Department of National Defense. But it does acknowledge the necessity for a closer coördination between the two services and for greater independence for the Air Corps from the General Army. All of which—though a hesitant step—is nonetheless a step in the right direction.

In the matter of military and naval aircraft procurement, however, the Commission makes its worst misstep. After such praiseworthy recommendations as that the air forces be kept up to full strength, that more funds and effort be spent in development work on those things where Uncle Sam is lagging, and that negotiated purchases be continued, the report stumbles and falls for the fallacy of limiting the number of companies producing military aircraft. That can mean only one thing—monopoly. And monopoly means inevitably a slowing down of progress, an atrophy of design ingenuity. In a national emergency, those things may mean the difference between winning and losing a war.

Concentrating Overhaul Faciliti





● Overhaul bases for transport planes are situated at the most strategic points on the airline. Time and efficiency are paramount considerations, and for these reasons, many companies have chosen as the locus for their maintenance bases, those airports which are accessible in the quickest time from any one of their central operating bases, and at which the most efficient work can quickly and expeditiously be done.

Among the largest bases in the country today is the Cheyenne, Wyoming unit operated by United Air Lines. Chosen for efficiency and economy, this overhaul and repair station can accommodate the entire maintenance and overhaul work on the fleet of 247 and 247-D Boeing transports which fly over the New York-Chicago-Pacific Coast, Vancouver-San Diego-Agua Caliente, and other airways operated by the company. The immensity of the project can be appreciated by the fact that approximately 400 persons are employed there, and the payroll is topped only by the railroad shops in the city.

Consolidation of all overhaul and repair activity at Cheyenne began during the summer of 1934 and was completed within thirty days without interrupting the necessary routine which subjects each twin-engined Boeing transport to a major overhaul after every 350-hour service period.

During the earlier years of United's operations, when the company consisted of four divisions, Cheyenne was the operating headquarters and maintenance depot for the Boeing Air Transport division from Chicago to San Francisco. The location of headquarters at this point was dictated by the fact that Cheyenne is the central point on the Great Lakes-Pacific Coast airways. Even after general operations control had been centralized in Chicago in the spring of 1934, the company continued to maintain separate repair and overhaul plants at Chicago (for the Chicago-New York and Chicago-Southwest lines); at Cheyenne; at Oakland (for the Pacific Coast route and western division of the coast-to-coast line); and at Portland (for the Salt Lake-Seattle equipment).

With the standardization of 247 type transports and a resulting uniformity of equipment over the entire system, the airline was able to carry out its long-considered plan to consolidate all of its overhaul and repair work at the Wyoming base. The central location of Cheyenne continued as the main argument in its favor, for considering United's entire system (including the three-nation coastwise service from Canada to Mexico) Cheyenne was unquestionably the most central point of operations.

Previous differences in equipment operated by the company had prevented the reorganization of the maintenance department on the foundation of one consolidated plant. However, with the line using but one type of flying equipment, it was obviously to the interests of uniform and efficient overhaul and repair practice to have the work conducted at one point only.

An administration building, constructed by United Air Lines several years ago, houses the administrative offices as well as a passenger waiting room and restaurant facilities. This two-story brick structure contains also the offices of the manager of the overhaul and repair base, the station manager, the accounting department and stock inventory group, in addition to others of less importance.

The biggest structure at Cheyenne is the main hangar which measures 150 by 200 feet. When the planes enter the hangar for their 350-hour check, the engines are immediately removed and set under way for overhaul. Then the airplane is subjected to a thorough cleaning inspection of different units, disassembling of cowling and portions of the skin and complete overhauling of all parts that require attention. Most of the space in this building, of course, is devoted to the hangar, but along the side are quarters for sewing, battery, propeller and stock-room departments.

In the sewing department skilled seamstresses are charged with the duties of repairing the upholstery of seats which require attention, making new curtains or repairing old ones and doing all other phases of sewing work involved in the repair and overhaul of the ships.

The battery room is responsible for the

The administration building and main hangar at Cheyenne where United Air Lines is maintaining a central overhaul and repair base for its fleet of Boeing transports

Maintain Airline Efficiency

careful inspection and frequent overhaul of the aircraft batteries.

The propeller department is an extremely well-lighted and efficiently laid-out unit for the inspection and overhauling of propellers. Considerable space is devoted to this shop due to the advent of three-bladed propellers on all United Air Lines planes.

Completing the departments included in the main hangar building is the stock-room. In connection with stock, it was felt that consolidation of its overhaul and repair base would necessitate the maintenance of an unusually heavy stock inventory due to the relatively great distance from eastern sources of supply. In actual practice, however, the company has found that this location does not require a wider supply of stock than would be necessary if it were located in Chicago. The schedule from Chicago to Cheyenne is 6½ hours, with all planes flying at night or in the early morning hours. The parts which are required for prompt use at Cheyenne, therefore, are routed from Chicago by company plane, whereas routine stocks are consigned for regular delivery to Cheyenne.

Supplementing the main hangar are several smaller buildings. Number one of this group includes the machine shop, an unusually well-equipped layout with modern lathes, milling machines, grinders, drill presses, etc.; a new addition to its equipment is an electric furnace for annealing and heat treatment. The engine accessories department which takes care of the overhauling and servicing of vacuum pumps, starters, magnetos, generators and such accessories, is also in this building as is the radio service department which handles the servicing and overhauling of transmitting and receiving equipment on company planes. Like the battery department and other branches of the Cheyenne base, the radio shop does not wait for the 350-hour checks before it takes equipment off the planes for service. The instrument shop, another unit in this building, is one of the most interesting departments at Cheyenne. Said by men in the industry to be the most complete and best equipped establishment of its kind in the country, it is divided into two sections. The large department is immaculate and well-equipped. One section takes care of the service of gyro instruments, while others handle the service and repair of less sensitive instruments. Complete testing equipment for all instruments is provided.

Number two of the smaller group of buildings is given over entirely to engine overhaul and repair. Engines are brought in, thoroughly cleaned, and then completely dissassembled. A definite production line is followed in the overhaul and repair base so that an engine entering at one door goes out a door at the opposite end of the building into the test stand.

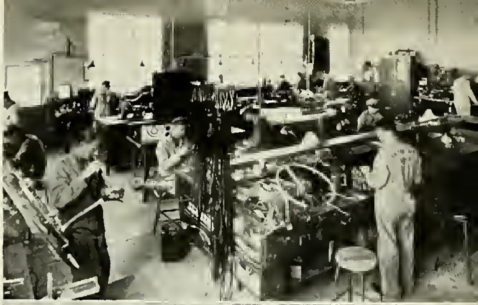
One of the newest additions to the equipment of the engine overhaul department is a "magnaflux" tester to detect flaws in engine parts.

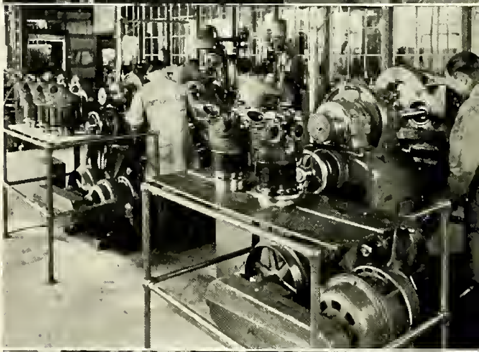
Number three of the buildings houses the welding sheet-metal shop. The most noteworthy feature of this department is the heavy press for the pressing of sheet metal parts and dies. These dies are cast in lead (lead being used as the actual dies for the pressing operation), and are made up at the repair base by company personnel.

Approximately five days after the airplane enters the hangar for overhaul and repair, it is taken out and put in line for a test flight, completely overhauled from stem to stern. Every inch of the plane has been thoroughly gone over, including the propellers, engines, fuel system, oil system, fuselage and empennage, landing gear, wings, flight controls and instruments. With the O.K. of the test pilot, the ship is ready to be returned for service on the airline.

One advantage of this system is the flexibility it permits in the handling of flight equipment. A plane may be in service between New York and Chicago as it approaches its three hundredth hour after overhaul. At this point, the dispatcher on the Chicago-New York division transfers the ship to the Chicago-Salt Lake section. It is then the responsibility of the Cheyenne station to check the accumulation of flying time on this airplane so that when it reaches its 350-hour mark it is landed at Cheyenne and taken out of schedule for its overhaul.

Boeing transports, taken from regular service at the end of their 350-hour period, undergoing inspection and overhaul in the main hangar of the Cheyenne repair base





EDITORIALS

> "My flight from Honolulu was attempted with no thought of proving anything aeronautical. I can only hope one more passage across that portion of the Pacific succeeds in marking a little more plainly the pathway over which the inevitable air service of the future will fly. To me, also, it seemed good training for other hoped-for long-distance flights."—AMELIA EARHART

The Future of The Autogiro

● The windmill plane has many points in its favor from a military or commercial viewpoint. A recent demonstration in Italy might perhaps foreshadow the partial displacement of the aircraft carrier. An English pilot, at the invitation of the Italian government, landed and took off from a cruiser which was not equipped with a flying deck. The plane used was the C30 direct control type now being tested at Old Sarum by the Royal Air Corps for liaison work.

Many other governments are interested in the potential use of the autogiro with ships. It has obvious possibilities in liners as well as men-of-war; the transportation of mail from ship to shore and occasionally of passengers who are in a great hurry are uses that immediately come to mind.

Past criticism of the autogiro has been that its advantages of slow flying under control and steep descents and ascents are not linked with performance and load capacity adequate for military uses in the relatively low-powered craft constructed up to the present. However, advancement in design presages increased speed and greater load capacity for the autogiro of the future. When that time arrives (and it is not far off), the autogiro should make a more secure place for itself in the commercial and military aircraft world. It will be interesting to see what the U. S. Army Air Corps discovers when it has experimented with the autogiros it will purchase after it opens bids on such aircraft this month.

Mass Training In Aviation

● Many young business and professional men have been eager to become better acquainted with aviation. The cost of instruction, the time required and the unavailability of such courses in many communities have, however, prevented them from more closely associating themselves with the industry.

An ambitious program to remedy these conditions has been undertaken by the Michigan Board of Aeronautics, which is now offering to adults, under the FERA, free courses in ground school work. Although only recently inaugurated, thousands of students have already signified their interest in aviation by enrolling for these night courses which extend over 30-class periods.

A two-fold benefit is evident. First, aeronautical instructors are put to work. Second, aviation can be materially benefited by a tremendous impetus to be gained by acquainting thousands of aeronautically-unversed persons in the foundations and rudiments of the science. Rather than hinder the private commercially-owned flying schools, it should aid them, since many of these ground school students will continue their work and will eventually buy flying time.

That Man's Here Again

● It was about a year ago that our job-dispensing Postmaster General hastily ordered the cancellation of all domestic air mail contracts. To this day the damages of that order have not yet been repaired, and some (particularly the lives of our Air Corps pilots which were lost as they acted the letter carrier) can never be replaced nor forgotten. Time and again, this despoiler of American principles has had the devastating results of his summary action confront him until it seemed he must at least realize (if not admit) the error of his action.

Apparently what happened before impressed him not at all, for Farley and his shadows, William Howes and Harllee Branch, have decided that things are too quiet. The public needs something to talk about, something which will make the man in the street think he's on the job.

And so, keeping their fingers crossed, they have dragged in before President Roosevelt another cancellation proposal.

This time, the ocean mail and foreign air mail contract holders are in line for a dose of the same quack medicine administered to the domestic air mail operators. Recommendations have been made to cancel or drastically modify these contracts so that the Post Office Department might (perhaps) save some money.

Pan American Airways will be seriously handicapped if these recommendations are carried out. The pity of it is that this company has done more for American business and commerce than Farley, his entire department and all his henchmen can ever hope to do. A trans-Pacific service is now in the formulative stage; orders have been let for equipment that will keep some of our aircraft factories busily engaged for months to come. Pan American Airways can be depended upon to make every effort to do its job despite stupid interference. To deter or hinder it in its work particularly at this stage of its development would be an invitation to the government to seek another darkly discolored optic.

A Bright Outlook

● The United States will attain the front-rank in international military aviation circles if the War and Navy departments continue the buying wave which recently has seen 431 aircraft purchased for our Army and Navy air services. To paint an even brighter picture, a tabulation of President Roosevelt's budget message to Congress shows that more than $60,000,000 has been requested for the next fiscal year with which a predominating aviation position might be assured.

The War Department gained $48,595,075 of which $20,737,072 was given to the Air Corps and $4,600,000 to the Signal Corps for equipping new and old aircraft with radio and ground communicating devices. The Navy Department stands to receive $22,500,000 for new aircraft needed as replacements and $12,500,000 for equipping the carriers now under construction with adequate airplanes. Furthermore, Army pilots will be allowed 300 hours of flying time, or more than three times the amount they were permitted in the past few years.

If Congress accepts the President's recommendations in full, the aviation industry is in a position to experience one of its most successful and busiest years. Considering the fact that in the past the government seems to have taken especially keen delight in pushing the industry about and playing political football with it, there is every reason to rejoice in the prospects for the future. There is occasion too, to give thanks to the members of the Baker Board and the Federal Aviation Commission, whose suggestions undoubtedly influenced the President to strengthen our aerial forces. While the Baker Board made a number of proposals and recommendations that were not entirely satisfactory to the industry, it did attempt to proffer a fair and politically unbiased report. Considering the immensity of its task and that undertaken by the Federal Aviation Commission, the results are complimentary to the members that composed these tribunals.

Airport Service From TWA

T. PARK HAY

Director of Public Relations, TWA.

Pilot Jack Frye and T. Park Hay

● Near the top of the list of TWA's Public Relations activities for 1935 is a program of cooperation with the owners of private aircraft which the airline hopes will result in making the private fliers, as they go about the country in their own planes, feel at home on the Lindbergh Line.

TWA officials have felt for some time that there has been an undeveloped relationship existing between the industries operating their own transport planes as well as the private fliers. This thought was brought to light in an opinion recently expressed by Jack Frye, president of Transcontinental & Western Air, Inc., that these private owners and operators of aircraft were doing more to create airmindedness among the general public than many of the transport operators have realized. While most of the privately-owned transports are used by executives in visiting their widely-separated branches, it is known that they often take guests with them, thereby introducing flying to thousands of people each year—a potential factor in air transport development which has not been fully appreciated.

TWA's plan to cooperate with private owners of aircraft goes beyond just a friendly gesture. It is considered to be the first move ever made by any air transport company to encourage these owners to use its nation-wide facilities and to make them feel at home on its system.

Mr. Frye has written to a list of private owners advising them that on TWA's route between Los Angeles and Newark, the company has been required to install a number of facilities, including airports at some of its locations, pointing to the fact that there are TWA employees at all airports and that the airline was desirous of assisting private operators by making all these facilities available to them should they make a trip over TWA's route in their own planes.

This offer advised the private owners that field managers and meteorologists will be pleased to furnish weather and pertinent information regarding trips at any time; that field personnel are familiar with all types of engines and have a complete knowledge of most modern planes.

In addition to the various services and information which are available, TWA will supply courtesy cards as a convenience. Those holding them (or the companies for whom they are flying) will be billed monthly for supplies and service received from the airline.

To be sure the offer will be utilized by business concerns and individuals who will value the courtesy and appreciate any extra services which the busy airport authorities will extend themselves to render, a form was enclosed with the letter which is to be signed by private owners. This authorizes the private owners' representative to pledge their credit for material, fuel, supplies, labor or storage secured or obtained from TWA.

Immediately upon receipt of this form, a courtesy card is issued which, upon presentation to any TWA representative at any of its airports, will insure what the airline terms "the kind of cooperation that the visiting pilot wants and appreciates".

To insure against any abuse of this privilege, these cards are not transferable. The individual companies who apply for this privilege are asked to designate the pilots to whom they want these courtesies extended, and are asked to cooperate with TWA against any fraudulent use of the cards by notifying the company in the event it is lost, stolen, or otherwise voided by the termination of the holder's employment.

Included among the list of recipients of TWA's offer are such private pilots as Wallace Beery, Frank Phillips, Fred Harvey, Felix duPont and Hal Roach; the private owners in the business world are Messrs. William Randolph Hearst, Powell Crosley, Jr., and E. W. (Pop) Cleveland.

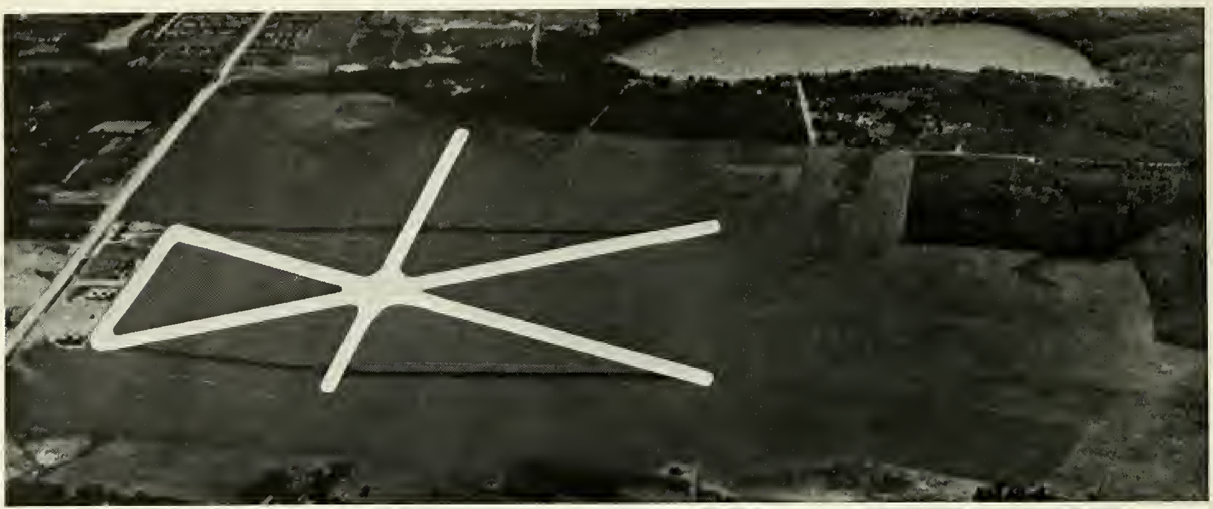
In a letter addressed to the Texas Company for instance, it was suggested that these facilities be extended to four of their flying personnel, J. D. Jernigan, Jr., Aubrey Keif, Hal Henning, and Pete Clauson. Among some of the other larger corporations with which noted pilots are associated are the Shell Petroleum Co., to which service offers were made for Major James Doolittle and James G. Haizlip; and the Richfield Oil Co., for Dudley Steele and Ralph Hall. Major E. E. Aldrin and John Porter are listed among the flying personnel in the Standard Oil interests as well as S. S. Chadderton of the Standard Oil Company of California. Another recipient of TWA's offer and one who will come nearer daily use of it than any one else, is Dr. J. D. Brock, who has made a flight in his own plane every day for the past three or four years. Other private owners who are flying their own planes for pleasure and to whom the courtesies were extended are: F. William Zelcer, Commissioner of Aviation for the City of New York; J. Cheever Cowdin; Frederick H. Harvey, W. E. Boeing and Henry B. duPont.

In order that TWA's guests may have a record of the services available at its airports between Los Angeles and New York, a complete tabulation has been provided which shows all the TWA services available, those available from other companies at these airports, the name of such servicing company, the service rate per hour (such as mechanics and their helpers), the octane rating of gasoline available and retail price of such gasoline including tax, and similar prices for lubricating oil per gallon. Storage rates at all terminals are listed, thus giving a complete picture of everything that can be obtained at these airports and the costs thereof.

The terminals at which these services are available are: Newark, Camden, Harrisburg, Pittsburgh, Columbus, Indianapolis, Chicago, St. Louis, Kansas City, Wichita, Amarillo, Albuquerque, Winslow, Kingman and Los Angeles.

TWA is hopeful that this flying group will take advantage of its facilities. The route flown by its planes is the shortest from coast to coast and is followed by nearly all speed fliers in attempting to break transcontinental records.

The personnel at the fields will be taught to realize the importance of complete cooperation with these visiting pilots and everything will be done to make them feel welcome and at home as they fly over the country on the Lindbergh Line.



Photograph retouched to illustrate how the work at Rhode Island State Airport will appear from the air when the project is completed

Modernizing The Rhode Island State Airport

A. PENDLETON TALIAFERRO, JR.

The author is president of A. P. Taliaferro, Jr. & Company, Inc., of New York City, and from 1929 to 1934 was Chief of the Airport Section of the United States Department of Commerce. Generally speaking, any competent engineer can design an airport if cost is no consideration, and an experienced pilot can furnish the plan for a landing area if unlimited funds are available. The problem is to merge these two experiences in order to produce the greatest amount of useful plant for the lowest cost

● The Rhode Island State Airport is a state-owned facility located approximately seven miles south of the city of Providence, on the New York-Boston airway. Until the summer of 1933, American Airways (now American Airlines) made a regular stop there for mail, express and passengers, but at that time, the roughness of the landing area and its muddy condition in wet weather caused a suspension of service.

In order to remedy this condition, a program of improvement was decided upon by the State Government. Preliminary estimates indicated that it would cost in the neighborhood of $450,000 to grade, drain and place a surface on the landing area and modernize the lighting system. The State sold its bonds in the amount of 70% of $450,000 applying for, and receiving, a grant of 30% of this amount from the Federal Public Works Administration. The lighting improvements were estimated to cost less than $10,000, and the balance was to be applied to improving the landing area.

Having been commissioned to plan and supervise the construction work, the author and his staff instituted a thorough check on existing available data, and supplemented these with extensive studies of their own which included taking of topography, examination and analysis of subsoil strata, existing drainage conditions, height of water table, and measurement of obstructions adjacent to the landing area.

Rhode Island State Airport showing surface conditions before reconstruction work was started

With these data available, numerous studies were made of possible runway arrangements. When considering intensity of air travel, the Rhode Island State Airport is not in a class with the airports serving the metropolitan area of New York or Chicago. However, the improvements now under way at the Rhode Island port will last for several decades, and it is reasonable to expect that at some future point in its development, particularly at peak-load periods during the twenty-four hours, the airport will be taxed to handle safely and expeditiously the number of private, miscellaneous commercial, and scheduled transport aircraft desiring to use its facilities.

The importance of planning an airport landing area from the standpoint of flow of the traffic that is to use it can hardly be exaggerated. With unlimited funds this problem would not be difficult, but generally the plan for a landing area has to be not only carefully worked out from the standpoint of aerial traffic flow, but also with the grading, draining and surfacing aspects of the particular piece of ground well to the fore, as these must be tied in with the plan for runways or landing strips. It is not particularly difficult to formulate attractive and efficient landing area layouts with a section of flat, well-drained, virgin, buffalo prairie to work with, but it is a different matter to work out a logical and safe landing area plan in terrain where the cost of grading, drainage, and surfacing must be kept in mind and fitted into the pattern of the funds available.

The plan for the Rhode Island State Airport, decided upon after balancing the factors mentioned, is illustrated in figure 1. In so far as possible, provision has been made to clear each runway without delay and eliminate the necessity for "back tracking" and closing the runway to planes taking off behind or those attempting to land. Owing to the deep depressions on either side of the eastern end of the E/W runway (which would have entailed a prohibitive expenditure to fill) the taxyway along this border of the field was not extended to the eastern end of the runway. No taxyway was provided across the southern portion of the field as it is expected that taxying planes will move in a counter clock-wise direction when proceeding for take-off points into the quadrant NE-SE and in a clock-wise direction when proceeding for points of take-off into the quadrant NW-SW. On paper, a constant direction of turn on the ground appears desirable, but a little study will indicate that in practice it would require an unreasonable amount of taxying under certain wind conditions. For example, if a constant counter clockwise direction were to be decreed, it would be necessary for a plane taking off into the west to make a 300° circle of the field before arriving at the point of take-off.

The apron is approximately 1400 ft. long and 150 ft. wide, and the runways are each 3000 ft. long and 150 ft. wide. When completed, no obstructions will exist within a 10:1 gliding angle and the usable area of the field proper extending for some distance to the S/W and S/E. The 150-ft. width was decided upon because of the insistance of air transport officials.

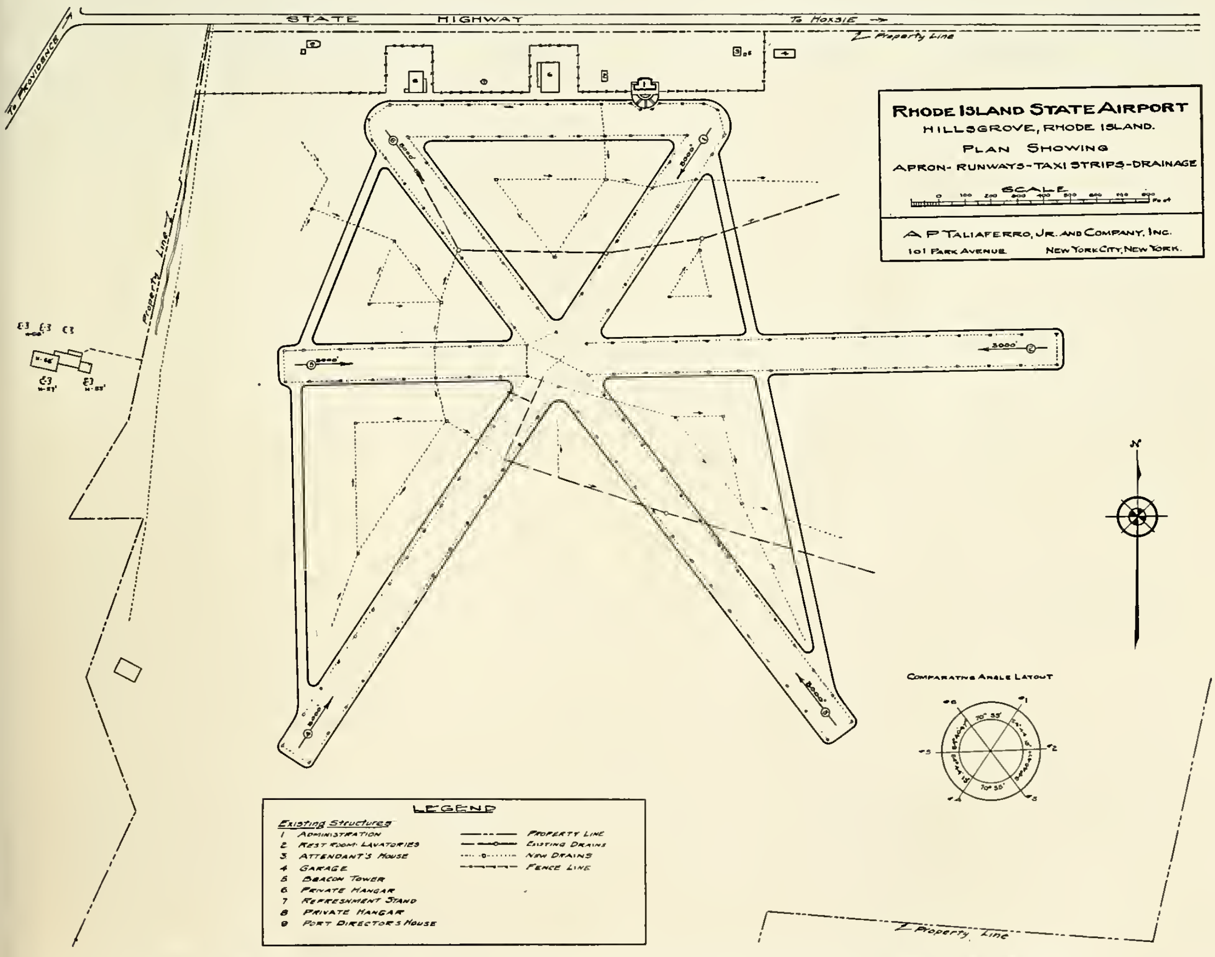


Figure 1. Plan showing layout of apron, runways, taxi-strips and drainage at Rhode Island State Airport

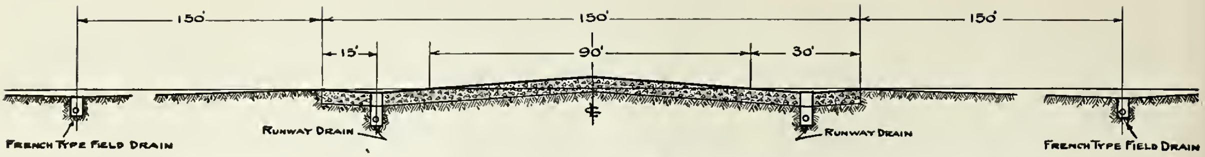


Figure 2. Typical cross section of concrete runway showing location and arrangement of drainage system

The airport, serving the capitol of the State, is essentially a transport facility, and it was planned from the standpoint of the most critical use to which it would be put; namely, the landing of high-speed transport aircraft during the hours of darkness and under conditions of poor visibility. Many ports are handling transport aircraft today with 100 ft. runways, but the additional 50 ft. gives an added margin of safety and makes snow removal easier. Frequently runways that start out with a hundred feet or more of cleared area during the first snows, gradually narrow until the banks begin to rise not more than 50 or 60 ft. apart.

The runways and apron are to be of re-enforced Portland cement concrete, the material being selected because of its low maintenance cost, visibility, and the fact that ground conditions were ideally adapted to this type of surfacing. Fills were shallow and sufficient money was available to install a drainage system including numerous collection basins that assured accurate control of ground water.

The cement will be of approximately 1-2-4 mix, re-enforced with sheets of steel fabric with steel dowels and ties at the joints. In most cases the slabs are 10 ft. × 60 ft. with 30 ft. between longitudinal expansion joints and 60 ft. between transverse expansion joints. The edges of the slabs at the expansion joints are thickened out to 8 in. whereas the normal thickness of the slab is 6 in. This increase in thickness at the end, both at the joints and at the edge next to the shoulder, gives added strength to the slab at the points where most needed, a design (with variations) accepted as good road practice by the United States Bureau of Roads, and the majority of states.

Taxyways are to be of bituminous macadam pavement placed on a cushion base of 6 in. of gravel foundation by the hot penetration method. They will consist of a wearing surface constructed in two courses, one of crushed stone as a base course, and a top or penetration course.

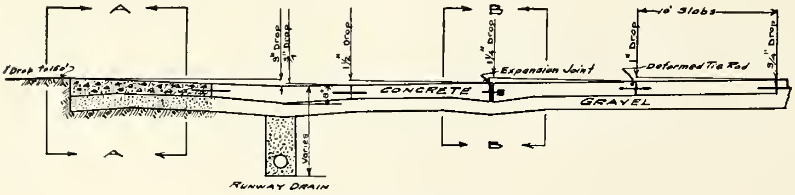
In grading the field, the top soil was stripped and stored for future distribution in order that a healthy turf might be developed on unpaved areas, and the dust nuisance controlled. The runway and taxyway courses were cut or filled as the case required, to subgrade, ready for the paving surfaces. In a few cases where soft loam pockets were encountered, such pockets were "mucked out" and firm material replaced to the subgrade. All grading, cutting, and back fill was done by improved type tractor-drawn graders which were extremely versatile in maneuverability and in adjustment as to depth of cut.

The drainage system is designed to maintain a fairly definite control over the water table at different periods of the year in order to insure, on the one hand, a low water level during the periods of freezing, and on the other hand, a high water table level during the dry summer months to assist the growing of sod. Experience has proven that the generally used system of draining into French drains paralleling the edges of runways is not entirely satisfactory. The ground adjacent to them is liable to soften and unless they are carefully maintained, airplanes taxying across them will scatter loose stone across the runway surface. Finally, they are liable to be frozen and inoperative during the Spring in northern latitudes.

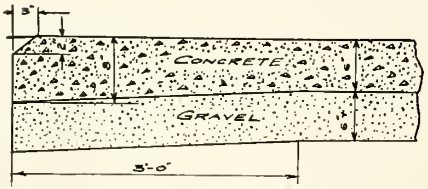
In the past it has been the general practice to drain airports with some type of underdrain with but few collection basins. In the Rhode Island State Airport design there has been no stinting of catch basins which have been frequently spaced along the lines of the drains and these are depended upon for the draining of the runways during the Winter months and in the early Spring when frost is in the ground. During freezing weather, French drains will in many cases be frozen to a considerable depth thus preventing percolation of water to the pipe, whereas with the numerous catch basins directly discharging into the pipe system, water may be quickly disposed of.

Since the runways are placed at a slightly higher elevation than the field proper, there are two separate systems of drainage—one for the runways, and another for the field areas. Longitudinal drains are located 15 ft. in from both edges of the runway. Water moves from the center crown of the runway to the slight depression forming the line of the drain, and from the edges of the runway inward to the same depression. Longitudinally, water flows in these depressions in both directions to conveniently-spaced catch basins. The profile of the runway gives the effect of a gentle double scallop with slopes so slight as not to be a menace to the operation of aircraft, but sufficient to handle surface water.

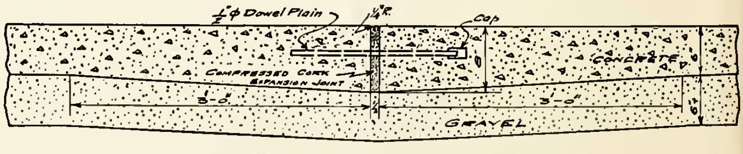
Although it is not possible to treat of the general layout and the drainage and surfacing plans for the Rhode Island State Airport in great detail here, basic discussions of the problems involved may be found in "Report of Committee on Airport Traffic Control" and "Report of Committee on Airport Drainage and Surfacing," published by the Department of Commerce.



Portion of Runway Cross Section.



Detail of Section AA



Detail of Expansion Joint - Section BB

Figure 3. Portion of runway cross section and two enlarged details of end sections and joints

Getting Lost in Fog or Stormy Weather

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CY CALDWELL

● Despite the use of every scientific aid now available for the safe navigation of the air; despite carefully framed Bureau of Air Commerce regulations governing the scheduled operation of interstate airline services, airliners still occasionally get lost in bad weather, to be discovered after a long search perched disconsolately among the branches of some sheltering pines. Nor is this casual and unpremeditated depositing of airliners among rural herbage confined solely to the younger and less experienced members of the piloting fraternity; only recently, I hear, the distinguished President of the Air Line Pilots Association, the Hon. David L. Behncke himself, complete with Boeing 247, was retrieved from a clump of willows and dusted off by some kindly yokels. It was at first reported, erroneously, that the distinguished President's jaw was broken; with a broken jaw good old Dave would indeed be incapacitated, and the tycoons of the airlines would emerge growling from their caves, seeking whom they might devour among the unprotected pilots.

Although it has long been the custom in aviation to soft-pedal all major and minor mishaps of the air, it seems to me that such a pianissimo policy is fundamentally unsound and timid, especially when newspapers the country over play up such misadventures in streaming headlines for the delectation of the rank and file of humanity whose travels are confined to subways, street-cars, buses, and trains. There is more joy in newspaper offices over one airliner that crashes than there is over the nine hundred and ninety-nine that fly safely to their destinations.

Cut Down the Causes

The airlines' only sound defense against such unfortunate publicity is to cut down the causes for it; and the purpose of this brief monograph is to indicate a form of procedure which, in a comparatively short time, should do much toward the elimination of accidents due to airliners getting lost in bad weather. But even if the fulminations of this beetle-browed philosopher are heeded. there still will be occasional accidents, for everything that moves faces the possibility of bumping into something else that refuses to move out of its way, and this includes steamships, railroad trains, automobiles, and men dodging furtively into saloons. Even though you and I try to achieve absolute safety by avoiding all travel, it will avail us little; sooner or later we'll rust out and die in bed, the victim of arterio-sclerosis or the heebie jeebies. So as Cole Porter sings, "When you see disaster approaching faster and faster, be like the bluebird and sing . . . Tweet, tweet, tweet!"

However, the idea of an airline pilot in a serious aerial predicament philosophically warbling "Tweet, tweet, tweet!" is not reassuring to airline passengers; they expect him (and not unreasonably) to do something, and get them out of whatever it was they got into that he didn't intend to get them into—such as a snow and sleet storm thirty miles off the course and the radio beam. If he doesn't do something, and do it right, the newspaper reporters and photographers, like hounds on the scent of a tired fox, will lick their chops, bay loudly, and proceed to the place where X marks the spot.

Let's Look at Chapter 5

The Bureau of Air Commerce regulations for airline operations are comprehensive, thorough, and sound with the notable exception of Chapter 5, Section 1, Paragraph 92 (E), which reads: (The first pilot shall) "Prove his ability to fly on instruments under a hood before undertaking passenger operation, and at least once every 90 days thereafter by a method specified in the approved section of the company's operation manual."

The specific question to which I would appreciate an answer from the Bureau of Air Commerce is this: How does a pilot's proven ability to fly on instruments under a hood for a comparatively brief period, in fair weather, within five miles of an airport and a radio beacon, demonstrate in any conclusive way that he will be able to fly with safety, and without getting lost, on a night when the weather is uncertain or bad, and when, for appreciable periods his radio may be rendered practically useless by static?

Is it seriously suggested (as Section 92 E seems to suggest) that once a pilot has demonstrated that he can fly around an airport by instruments that, without supplementary training in bad weather flying by instrument in actual cross-country conditions, he may be considered wholly qualified for "undertaking passenger operations"? If so, then giving him a Scheduled Air Transport Rating on such inconclusive tests is in some respects the same as issuing master's papers to a steamship captain who has been instructed how to navigate in mid-Atlantic by pulling down the shades of the pilot house, and having him steer the ship in a circle in the vicinity of a safe harbor—with another captain peeking out to see that they don't run into anything. Such a course of instruction, while it could include the method of steering the boat and the meaning of radio information, would fail to take into consideration such mid-Atlantic phenomena as ocean currents, winds, fog, rain, snow, and the possibility of icebergs or other vessels being in the ship's path. Hence officers learn how to command ocean liners by working up from minor positions, under the strict supervision of a long line of older and more experienced ship's officers, thus combining instruction and study with actual experience of all sea conditions encountered, winter and summer, day and night, in fair weather and foul.

While aviation still is comparatively very young, it already has produced many pilots who have experimented for years and who have managed to survive and accumulate a broad experience in instrument flying—such pilots as Bill Williams, Wesley Smith, and Howard Stark, to mention only an outstanding trio whom I know personally. These men, and others who have thought and flown along similar lines, convinced that flying by instruments and not by visual contact with the ground was the only safe way to fly, are, I repeat, survivors from a courageous group, not all of whom were fortunate They are veterans of instrument flying; and to be a veteran instrument pilot or a veteran pilot who always has followed the railroad tracks are two different things, as different as day is from night. As an old railroad track pilot, I am frank to admit the difference, recalling how I was baffled one rainy day when the track went through a tunnel in mountainous country.

Railroad Track of the Air

The modern railroad track of the air is the lighted airway and the radio beam, and there is many an airline pilot to-day who follows that directing track with comfort and growing assurance. But let it run into the tunnel of prolonged static, which renders the radio almost useless for certain periods; let it run into the tunnel of rain, snow, or fog which blots out the lighted airway, and the pilot who has not had long experience in flying blind may find himself lost, wander from his course, and end up on a snow-covered mountain from which it will take the combined efforts of a fleet of airplanes and a group

(*Continued on page* 76)

Specialization and Profit at the Air Terminal

● When Major C. C. Moseley assumed the management of Grand Central Air Terminal in Glendale, Calif., his objective was to assemble one aeronautical specialist from each division of the industry so that team-work could be developed through the elimination of conventional competition. The feasibility of the plan is evidenced by the fact that the airport has been successful ever since, and throughout the depression there were enough profits to eradicate red-ink tribulations. It has always been a privately-owned institution. No part of its construction and maintenance costs were ever borne by the city of Glendale. On the contrary, it has paid taxes and various other fees.

These conditions made possible the formation and use of the objective-policy now associated with the enterprise and having never been a political football, it has been devoid of handicaps imposed upon many promising airports. It was the first completely equipped commercial airport established in southern California, and is five minutes from Glendale, 12 minutes from Hollywood and 21 minutes from the center of the business district of Los Angeles.

Built on an irregular plot of 181 acres, Grand Central Air Terminal has a flat, well-oiled sandy surface that is dry even during the rainy season. Two runways are provided; one runs NE/SW for 3700 feet and the other extends NW/SE for 3000 feet. In addition, concrete aprons have been provided near the hangars and at one end of the runways.

Lighting equipment consists of beacons, boundary, obstruction, approach, landing area floodlights and a 24-inch rotating beacon. The terminal building is of Spanish architecture and houses the waiting and rest rooms, restaurant, weather bureau and other facilities.

Grand Central Air Terminal has been permitted to develop normally. It was a splendid proposition when it inaugurated operations and it has been improved and advanced during each succeeding year.

In this colony of specialists three major airlines and two of lesser importance represent scheduled air transportation. Two internationally-known schools, one offering aviation engineering and master mechanic courses and the other teaching private and commercial flying, indicate the extent of the educational features. Two major aviation engine distribution agencies are on a par with the two newly-built aircraft distribution sales organizations wherein each occupies its individual place in general civil aeronautics. In addition, one of the foremost manufacturers of air transport equipment shares tenancy with the other facilities.

There is a used airplane concern which buys, sells or trades anything flyable and what formerly was an aircraft manufacturing organization now specializes in rebuilding or repairing all types of flying equipment. Shops associated with general aviation offer a variety of service and accessories, both new and used, with full service facilities for all, are also available.

Weather forecasts, expertly-prepared courses, aerial photographers, all forms of communicating systems and a monthly publication specializing in information for pilots are included.

American Airlines sends its Curtiss-Wright Condor sleeper planes from Glendale via Fort Worth to Chicago, New York and Boston; Central Airways of Mexico (an affiliate of Pan American Airways) uses Lockheed Electras between Glendale and Mexico City; Palm Springs Air Transport flies Stinsons between Glendale and Palm Springs; TWA employs Douglas transports from Glendale via Kansas City to New York; and the Williams Air Service operates Fairchilds between Glendale and Death Valley points. These airlines fly five different types of transports over five different routes to widely-scattered destinations.

The Airplane Development Corp. manufactures the high-speed, all-metal, single-engined, ten-place Vultee transport. This factory occupies one hangar and several additions, specializing in this one type of transport, which (at full-time capacity) can be turned out at the rate of about six per month.

The Kinner Airplane and Motor Corp., Ltd., maintains a hangar-salesroom for its airplanes and engines, six types of each being in the complete line.

Aircraft Industries, Inc., is southwestern distributor for Stinson airplanes, Lycoming and Wright engines and Smith controllable-pitch propellers. Its shops are singularly equipped for all varieties of aeronautical service. Many owners in Central and South America send overhaul and repair work to this institution.

Charles H. Babb is the used airplane dealer. Air Associates carry a complete stock of accessories and have done twice the business they expected for the year. The present set-up includes everything the pilot or mechanic needs.

A. Biederman, instrument expert, specializes in checking and repairing every type of flying instrument and the Timm brothers maintain airplane repair shops and are equipped to handle any airplane job.

Western Propeller Co., represents efficiency in service on propellers. Personnel and precision machinery are available for all requirements.

(*Continued on page 75*)

International air service at Grand Central Air Terminal

Recommendations of the Aviation Commission

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● The report of the Federal Aviation Commission transmitted to Congress by President Roosevelt on January 31st, brings to a climax months of investigation, study and survey of the industry. Personal observations were made by the Howell-headed board; and public hearings brought more than a hundred witnesses before the commission before the report was prepared.

Every phase of the industry is covered; 102 recommendations are made and the complete report contains 254 pages of printed material. As it would be impractical to present here the complete discussion, all the recommendations and discussions of a few recommendations are presented.

Air Transport

It should be the policy of the United States to maintain a position of world leadership in air transport, and to lend such aid as may be necessary to insure that the most modern and efficient equipment and methods shall be applied on American domestic and foreign airlines.

There should be no legal limitation upon the growth of air transport.

The carriage of mail should be put on a commercial basis, with payments to lines within the amount received by the Post Office. Whatever additional sums are for the time being necessary to maintain and develop adequate transport services should be allocated specifically to that purpose by the government.

There should be a close and continuous governmental control of the financial aid having to be given to airlines. Certificates of convenience and necessity should be issued under proper safeguards and specifications. Provision should be made to specify a minimum quality of service and a minimum frequency of schedule on airlines. Rates of fare should be subject to governmental approval, and the financial structure of airlines should be supervised and their general conformity with the letter and spirit of the law watched over by appropriate governmental agencies. For these purposes we suggest the creation of a nonpartisan commission.

All regular domestic scheduled transport operations should require a certificate of convenience and necessity, to be issued by the commission hereinafter proposed. Such certificates should not be cancelled except for good cause without equitable compensation to the holder.

Direct Federal aid should not as a matter of course be extended to all airlines having certificates of convenience and necessity, but only to such airlines as are deserving of such aid in the public interest.

Every airline operating on December 1, 1934, should be considered to have a presumptive right to the receipt of a certificate of convenience and necessity.

The development of new airways and the provision of navigation facilities thereon should be a responsibility of the Department of Commerce, subject to commission approval.

It should be the general policy to preserve competition in the interest of improved service and technological development, while avoiding uneconomical parallelling of routes or duplication of facilities.

The Post Office Department should be free to use any service that exists, without being limited by specific contracts.

The rates to be paid by the Post Office Department to airlines carrying mail should be fixed by the commission hereinafter proposed.

The direct financial aid given to airlines should be under the constant control of the commission, and subject at all times to revision as technical improvement, changes in operating conditions, or the needs of the particular territory served may require. The formulas under which aid is extended should be such as to encourage good management and technical progress, and to stimulate rapid evolution towards complete self-support and independence of direct governmental aid.

The control of a multiplicity of airlines through holding companies should be prohibited. The ownership of stock in airlines by corporations engaged in other activities, or the interlocking of diverse aeronautical interests, should be strictly controlled by the commission hereinafter proposed. Nothing should be permitted which would in any way reduce the effectiveness of any competition, the preservation of which could serve the public interest, or which would interfere with the exercise of the government's regulatory functions. Subject to these paramount considerations, the door should be left open as far as possible for a free flow of investment capital into air transportation in the interest of a strengthening of its structure and an improvement of its facilities.

Airlines should be made eligible, as railroads now are, for loans from the Reconstruction Finance Corporation upon suitable security.

In connection with the placing of the carriage of air mail upon a strictly commercial basis, involving no net financial burden upon the Post Office Department, there should be authorization for experiments with special classes of light-weight air mail matter carried at a low rate, in the interest of an increase of the total volume of air mail and the gross receipts of the service.

It should be a duty of the commission hereinafter proposed to require periodic financial and operating reports from all airlines, to examine into their status at suitable intervals, and to make public record of such reports.

It should be the policy of the commission herein proposed to subscribe to the principles contained in Section 7 (a) of the National Industrial Recovery Act, and to foster adherence thereto, in all branches and activities of air transport; and to use its influence to bring together employers and the duly chosen representatives of their own choosing of the several crafts and callings with a view to agreeing upon a method of procedure to be followed in the handling and adjustment of all questions involving wages, hours, and conditions of employment.

The control, in the interest of public safety, of the minimum standards of equipment and the operating methods and organizations and ground facilities of civil aeronautics should continue approximately as at present, but under the jurisdiction of the proposed commission.

There should be no attempt to require the inclusion of military features in the design or equipment of transport airplanes.

Air transport in American territories and possessions should be developed, and in particular there should be an increase of air transport service and ground facilities available for air navigation in Alaska.

The national policy of stimulating air transport should extend to the promotion of American-flag airlines connecting the United States with our territories overseas and serving our major trade routes to foreign countries. The time has now come when air transport can be regarded on a world-wide basis, and in particular when the early inauguration of regular trans-oceanic services by aircraft can be foreseen. (*Continued on following pages*)

The Secretary of Commerce should study ways and means to foster American airlines to foreign countries and recommend to the Congress, from time to time, legislation governing the extension of financial aid. Consideration should be given to the nature of similar aid given the merchant marine, with a view to developing a coordinated policy.

The policy of making available for the carriage of mail all American airlines rendering regular service, and of payment by the Post Office Department to the airlines only for service rendered, should be extended to future arrangements for foreign airlines. The rates of payment to the airlines for the carriage of mail should be fixed by the commission hereinafter proposed, and such additional aid as may be necessary to build up and maintain a proper service under the American flag outside of the boundaries of the United States should be allocated by the commission.

No changes should henceforth be made in the existing foreign air mail contracts except with the approval of the commission hereinafter proposed.

The governmental administration of foreign air transport should as far as possible be kept similar to that of the domestic airline system, but with such modifications as may be clearly necessitated by a fundamentally different political, legal, and operating status. The status of American air transport in foreign fields competing with foreign-owned airlines should in general not be one of competition between American lines, but of carefully-controlled regional monopoly. The general powers of the commission hereinafter proposed in connection with foreign air transport should be essentially similar to those which it enjoys in the domestic field, and the commission should have the additional power of stipulating for fixed periods certain minimum and maximum conditions of service and of governmental aid in the interest of stability of the undertaking and of encouragement of large investment in ground facilities.

The policy of the United States should be to support and assist American airlines in their relations with foreign governments and with foreign competitors. It should be considered as in the public interest to regulate and control foreign airlines entering the United States with the purpose of securing for American airlines equality of opportunity in foreign countries.

It should be provided by legislation that American airlines outside the continental United States should have the same opportunity now given by the Shipping Act to American steamship lines to enter into trade and traffic agreements with their competitors. Such agreements should be subject to approval by the commission hereinafter proposed.

The existing regulations for customs clearance, immigration, and public health clearance should undergo early revision and the greatest possible measure of simplification to meet the special problems of aircraft operation in international service.

As a measure of immediate emergency, the present Air Mail Act (Public 308, 73rd Congress) should be amended so as to empower the Interstate Commerce Commission to revise existing air mail rates either upward or downward as the facts may warrant, and subject to such revision existing contracts should continue in force until such date as the commission hereinafter proposed, in the exercise of its full powers and duties, may prescribe.

As a measure of immediate emergency, the provisions of the present Air Mail Act (Public 308, 73rd Congress) regarding the designation of primary and secondary routes, and the prohibition of an airline from holding more than one primary and two secondary route contracts, should be amended so as to postpone their effective date to January 1, 1936.

Miscellaneous Civil Aviation

It should be the policy of the government to impose a minimum of regulation upon private flying, and to determine that minimum with reference to public safety alone. The technical regulation of aircraft and personnel engaged in commercial activities should remain substantially as at present.

In the interest of improved utility and increased safety of aircraft suitable for private use, and to extend the scope of the ownership and operation of aircraft by private individuals, the Department of Commerce should be authorized to make experimental purchases by negotiation of aircraft or other aeronautical equipment seeming to promise special advantages to civil aviation and not likely to be promptly developed otherwise, and to pay substantially the full development cost therefor. Such purchases should have the prior approval of the National Advisory Committee for Aeronautics.

The National Advisory Committee for Aeronautics should give the development of those qualities in aircraft which render them particularly suitable for private operation an enlarged place on its program of research, and should cooperate with the Department of Commerce in determining the qualities and performance of aircraft of new types which may be offered for consideration.

There should be a general survey of governmental mapping projects and other undertakings requiring the observation of wide areas to determine the extent to which aerial survey or observation can profitably be used. Where such work is economically advantageous it should be done by contract by commercial aircraft operators wherever reasonable bids can be obtained.

Fixed-base aircraft operators, maintaining schools, service stations, and charter services, should be made eligible for Reconstruction Finance Corporation loans upon proper security, in the same way as manufacturing industries and railroads are already eligible.

The usefulness of gliding and soaring flights in the promotion of aeronautics, and in the aeronautical activities of the various departments of government, should be carefully studied. In particular, the authorities charged with the technical regulation of aircraft should give special consideration to glider problems and to means of simplifying the formalities connected with glider control and licensing.

Airports

The installation of lights and other navigational aids should be undertaken by the Department of Commerce at airports designated by the commission hereinafter proposed as forming effective elements in a national airport system. The cost of maintenance of such lighting equipment, or of that already installed by local enterprise when designated by the commission, should be shared between the Federal Government and the appropriate local agency.

It should be the policy of the Federal agencies concerned to provide airports and glider sites in or adjacent to recreational areas under Federal control, such as national parks and monuments.

Action should be taken without further delay for the early determination of the site of a permanent airport for the national capital, and for the provision there of a model airport installation.

National Defense Organization

The modification in air force organization now being put in effect should be continued until their merits or otherwise shall have been proven by experience. The employment of air force as an independent striking unit should continue under constant study, both in the Army and in the Navy, and should be developed to its limit by tactical maneuvers and through the procurement of material best suited to such independent operations.

The personnel and equipment of the air forces should be further developed, and where necessary expanded, in accordance with fixed programs of regular growth based upon the current plans of the Army and Navy. The effectiveness of the forces should be kept at the highest pitch by constant attention to superior quality of equipment and of personnel, and by the conduct of training exercises under widely diversified climatic and geographical conditions offering the greatest possible variety of operating problems.

(*Continued on following page*)

IT MAY NOT HAPPEN once in a million miles of transport flying, BUT...

LET'S look at a few facts that any veteran pilot knows about winter flying.

It's a lot safer than it used to be. We can all grant that.

BUT—sudden blizzards *can* blanket landing fields with snow while your ship's in the air—sudden thaws *can* turn frozen fields soft and muddy between sun up and sun down—bad weather *can* shut down over an area so big that you can't get over or around it.

So what?

Just this—if you ever *do* have to set a ship down on snow—or mud—or a sandy beach—or maybe a plowed field—you can be mighty thankful if that landing is made with Airwheel* equipment.

Airwheel equipment means two important things:

First—tires so big and soft that they spread out and give a safe footing under landing conditions where planes with other types of tires would sink down and nose over.

Second—smooth action—non-fading—sure-releasing hydraulic brakes designed exclusively for airplane use—brakes that will "stop on a dime" when you have to!

We've told this story a good many times—but if you're still one of the dwindling minority who haven't done anything about it, we'd like to suggest you sit down now and write for the records and facts that back up what we've said here. Just write Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

★ IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL! AIRWHEEL is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of AIRWHEEL Tires

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WHEN YOU BUY A NEW SHIP SPECIFY THE GOODYEAR AIRWHEEL AND THE NEW GOODYEAR HYDRAULIC AIRWHEEL BRAKES

(*Continued from preceding page*)

Intense study and prompt remedy should be given to the inter-relationship of the national defense Services.

The budgetary practices of the Army and Navy in respect of aeronautical matters should be standardized for easy comparison. In both Services the funds for equipment to be used on aircraft should be directly allocated to the authorities in charge of aeronautical development, and subsequently transferred to other branches or offices if necessary.

A number of officer pilots of the regular Army and Navy should be assigned annually to the other Service, and given duty with other active air units.

The experimental and developmental work of the Army and Navy should be carried on on an increased scale. The funds provided for such work should be materially increased, as the necessary consequence of the increasing complexity of aircraft and engine construction. Special allocations should be made by both Services for a particularly vigorous developmental campaign on high-powered and highly supercharged engines, and on power-plants of Diesel type.

Funds appropriated for experimental purposes, and not paid out when expected because of a failure of an article to meet the contractor's guarantees or a failure of any contractor to come forward with an article meeting a Service specification under which funds had been set aside, should remain available until used.

There should be a closer coordination of Army and Navy experimental and developmental work, and the National Advisory Committee for Aeronautics should be more largely used as an agency for such coordination. A much higher degree of uniformity than now exists should be attained in auxiliary material and the methods for its development, and also in the practices of the Army and Navy in technical matters as analyzing aircraft for strength, performance testing, etc.

Arrangements should be made for the temporary attachment of a few officers of the Army and of the Navy to civil activities, and especially to air transport, for study in order that the armed Services may secure the greatest benefit from civil aeronautical experience.

The War and Navy Departments should adopt the practice, where possible without increase of cost to the government, of making reasonable use of the facilities of approved civil aircraft repair stations for repair and service work on military and naval aircraft.

There should be immediate and positive action to improve the promotion situation in the Army, with special reference to the Air Corps. The authority to provide temporary rank in the Air Corps, to make the rank commensurate with the responsibilities held, should be broadened and then used.

The authority to select a Chief of Air Corps from among all the officers of long service in that arm, which has now expired, should be renewed.

The maximum term of active service with regular forces on the part of Reserve pilots graduated from the Army and Navy training schools should be increased, at least to three years and perhaps further. A cash payment should be given upon termination of this duty to ease the shock of transference to civilian life.

Cadets accepted for training in either the Army or Navy flying schools should be required to take a definite obligation to perform a definite period of active duty after graduation, except as their resignations may be accepted in the discretion of the War or Navy Departments.

The aviation Reserves both of the Army and Navy should be materially strengthened, and should receive a higher priority than they at present enjoy in the allotment of funds. Consideration should be given to the establishment of Assistant Secretaries of War and of the Navy for Reserve or personnel matters. Their duties would include the encouragement and maintenance of a more effective Reserve force in both Services, particularly with regard to the fields requiring a specialized combination of technical ability and military training.

The Army and Navy should organize special classifications in the Reserve for essential personnel of airline organizations, and every effort should be made to secure the enrollment of such personnel in one or the other of the Reserve forces.

The War and Navy Departments should give serious study to measures of securing a general enrollment in some category of the Reserve of private pilots and commercial pilots other than those employed in air transport, to the maintenance of an appropriate check on the individual qualifications of civil pilots, and to the establishment of special training courses to supply highly trained civil pilots with such specifically military training as might be necessary to make them immediately effective members of a reserve.

There should be created a new type of government insurance for Reserve officers, covering the aviation hazard exclusively, available in amounts substantially beyond the present $10,000 limitation, and with premiums arbitrarily maintained on a very moderate scale. The personnel of the aviation Reserves should receive the same protection in case of injury or death in line of duty as would be given to Regular officers under the same circumstances.

The provision for officer personnel of special engineering ability and industrial experience in the aviation field should be reconsidered both by the Army and by the Navy. An adequate number of such officers should be developed and given assurance by legislation of attractive careers in the Service. In the case of the Navy at least, we recommend the commission of such officers in a staff corps to insure continuous employment on duties connected with their specialty.

Procurement of Military and Naval Aeronautical Materiel

The paramount importance of quality in military aircraft should be recognized, and procurement policies should be fixed with primary reference to the securing at all times of the best material. Price should not be the primary consideration.

The general purpose in the relations of the government to the industry engaged in manufacturing Service aircraft should be to maintain units sufficiently stable and sufficiently well organized so that they would be available for expansion in the event of war. The strength and efficiency both in design and in production of the individual manufacturing units, rather than the number of independent units existing, should be regarded as the test of the nation's industrial preparedness.

Procurement policies should be planned to encourage the development of integrated manufacturing units carrying on their own research, development, design, and production work.

The practices of the government departments procuring aircraft should, as far as practicable, be the same. The Federal Director of Procurement should promulgate the necessary directions to this end.

Every effort should be made to organize procurement policy so that the supply of each general type of aircraft for replacement and for modernization should proceed at a substantially regular rate, and so that there may be a substantially regular flow of productive work in the plants of the aircraft industry.

The War and Navy Departments should so organize their technical forces as to obviate the simultaneous functioning of any personnel in the roles of competitor and of judge.

The development of new types of aircraft should continue to be provided for either by design competition or by experimental contracts for a specific article, but the rules now governing formal design competitions should be modified to allow administrative flexibility, and in particular to provide for the holding of competitions in which design development is allied with experimental construction of the article designed.

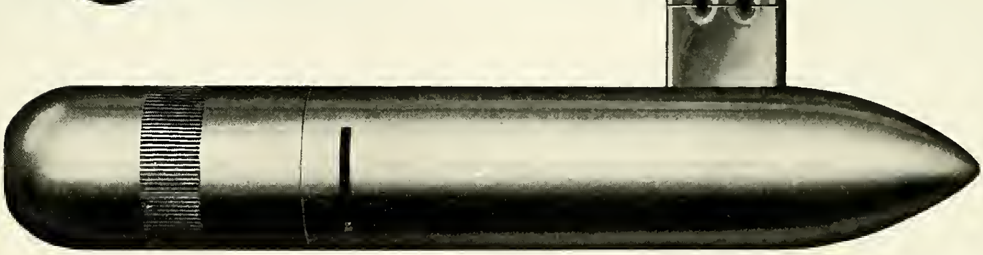
The Army and Navy should adopt a policy in holding design competitions by which details of the military characteristics of the aircraft and equipment desired to be created shall be disclosed only to fully responsible competitors, of American nationality, and qualified for the work contemplated in the opinion of the Secretary of War or of the Navy.

(*Continued on following page*)

PIONEER ROTATABLE AIR SPEED INDICATOR and ELECTRICALLY HEATED PITOT STATIC TUBE

ROTATABLE AIR SPEED INDICATOR *Type* 735 is an essential instrument, carefully designed to be quickly and easily read in conjunction with other instruments of the flight group. It is usually placed immediately to the left of the Turn Indicator... the Climb Indicator being placed on the opposite side.

The mechanism may be rotated so that when a predetermined air speed has been attained, the pointer assumes a horizontal position on the right hand side of the dial...The Rotatable Airspeed Indicator employs the same high grade mechanism used in all standard Pioneer instruments. Available ranges, 200 to 300 MPH.



ELECTRICALLY HEATED PITOT STATIC TUBE, *Type* 357D... positively prevents ice formation at low temperatures, thus insuring operation of the Air Speed Indicator at all times...It is an established fact that within a certain low temperature range, ice will rapidly form on various parts of an airplane. The Pitot Static Tube, because of its small dimensions, may be rendered completely ineffective often before the airplane itself has been seriously affected by the ice load. Concurrently with this ice forming condition, low or zero visibility is usually encountered, making it necessary for the Pilot to depend entirely upon his instruments. The perfection of the Heated Pitot Static Tube makes possible reliable airspeed indication, regardless of temperature. To provide for various methods of mounting, Pitot Static Tubes, type 357D are offered in three models. All three models have the same Pitot Static section as illustrated above.

PIONEER INSTRUMENTS

PIONEER INSTRUMENT COMPANY INCORPORATED
BROOKLYN • NEW YORK • A SUBSIDIARY OF THE BENDIX AVIATION CORPORATION

(*Continued from preceding page*)

The announcements of design competitions should include the statement of the fixed price at which, subject to bonuses and penalties for performance, machines from the best designs will be purchased from the originators of the types.

Where the interests of the government clearly require that the construction of equipment from a particular design be thrown open to general competition or that orders for such construction be allocated to others than the originator of the design, royalties should be paid to the originator in reimbursement for the right to use his drawings, calculations, and production information.

The attempt to introduce a standard catch-all patent-license clause into all developmental contracts for aircraft and aeronautical material should be abandoned. Reproduction rights on patentable inventions should accrue to the government, in connection with a developmental contract for purchase of an article embodying the inventions, only in case the contractor is engaged to conduct a specific experimental development under governmental direction.

Existing provisions of law should be amended as necessary to allow direct suit (but not injunctive procedure) against a manufacturer alleged to be infringing a patent in connection with work done by him for the Federal government.

Explicit authority should be granted to the Secretary of War and to the Secretary of the Navy to negotiate contracts for quantity purchases of aircraft and other aeronautical material, subject to the requirement of a full report to Congress in each case where the authority is used.

In order that there may be no incentive for an uneconomic expansion of plants that could not be kept regularly running at anywhere near their capacity, it should be procurement policy to avoid any concentration in any one plant of an abnormally large proportion of the total military and naval work then outstanding.

When purchases are to be made as the result of a process of competitive bidding, the Secretary of War or Secretary of the Navy should be authorized either to award a contract for the whole quantity sought to the bidder who can best perform the work, or to divide the work among two or more bidders if that be in the best interest of the government.

Where definite profit limitation is to be employed, as in the present Naval Construction act, it should not be applied to the individual contract, but, in the interest of equity, of simplicity of accounting, and of stimulation of technical development, should be extended over all the work done for the government Service over a considerable length of time.

Industrial mobilization plans in the field of aeronautics should be pressed by the joint effort of the Army and Navy.

Coast Guard

The Coast Guard should give to its aviation personnel essentially the same opportunity to specialize on aviation duty over long periods as does the Navy.

A limited number of aviation specialists should be allowed to enter the Coast Guard directly upon completion of their terms of active duty as reservists with Naval aviation.

The Coast Guard should procure its aircraft through the Navy Department, which should assume the responsibility of necessary experimental and developmental work to produce equipment especially suited to Coast Guard needs. Both experimental work and quantity procurement for the special purposes of the Coast Guard should be covered by Coast Guard funds to be transferred to the Navy Department for the purpose.

Lighter-than-Air Craft

It should be the policy of the United States to undertake further construction and operation of rigid airships in naval and commercial service.

The Navy should determine by actual experience the scouting value of airships and the need for their further construction for naval purposes.

The prompt construction for the Navy of a training airship to replace the *Los Angeles,* as recommended by the Navy General Board, should be undertaken.

The early inauguration of an experimental trans-Atlantic airship service should be undertaken to meet the competition of the newest foreign ocean liners and of a projected foreign airship line. The initial step should be the construction by the government, for charter or lease to a commercial operator, of a commercial airship and a commercial terminal, with necessary docking and handling facilities.

The production of helium by the Bureau of Mines should be continued, with authority to sell helium to commercial users and to foreign purchasers for export when it is available in excess of naval and military needs. Such domestic sales and export sales should be subject to the approval of the commission hereinafter proposed and should involve no net cost to the government. Export of helium from production by others than the Bureau of Mines should also be subject to approval of the commission.

The helium tank cars now owned by the Army and Navy should be transferred to the Bureau of Mines.

Relations of Government and Industry

The degree of control by the government of the design and construction of civil aircraft should remain for the time being approximately as at present. The ultimate purpose should be a minimizing, in the degree consistent with public safety, of detailed control over the work of responsible manufacturers maintaining an adequate inspection and engineering organization of their own.

The examination of a new type of aircraft by the government should include a numerical determination of all the essential elements of performance, and the figures so obtained should be recorded in the approved type certificate.

Every assistance should be given by the appropriate agencies of government to manufacturers of commercial aircraft, engines, and accessories seeking an export market for their product. In those cases where possible military and commercial applications exist for the same article, there should be no presumption of prospective military use in the absence of any specific evidence pointing in that direction.

The State Department and Department of Commerce should make every effort to obtain an increased number of international agreements for the mutual recognition of airworthiness certificates, with the object of permitting a free trade in aircraft and the free travel of private owners in their own machines.

The principle of cross-licensing of patents in the aircraft industry should be recognized as beneficial to the government and as promoting a rapid development, and should be encouraged. The government should take an active interest in the operations of a cross-license association, membership in which is open to all on reasonable terms, to insure fair treatment for all participants in its affairs and to protect the government's interest. The commission hereinafter proposed should be authorized to act as an adjudicator, either between private parties or between a private party and a government department, in such cases arising under such an agreement as the commission may elect to hear.

Research and Education

The National Advisory Committee for Aeronautics should remain the central agency of governmental research in aeronautics, and also the recognized body for coordinating experimental and developmental work of the various government departments and the results obtained from the researches of various institutions. It should extend its mechanism of unpaid subcommittees to include frequent conferences upon particular questions with technically qualified representatives of the commercial industry, and to draw the industry's personnel engaged in the development of aeronautical products more directly into the planning of its research work.

The best qualities of present-day aircraft are preeminently due to organized research work, and the work done by the government in that field has paid for itself repeatedly in the improved service

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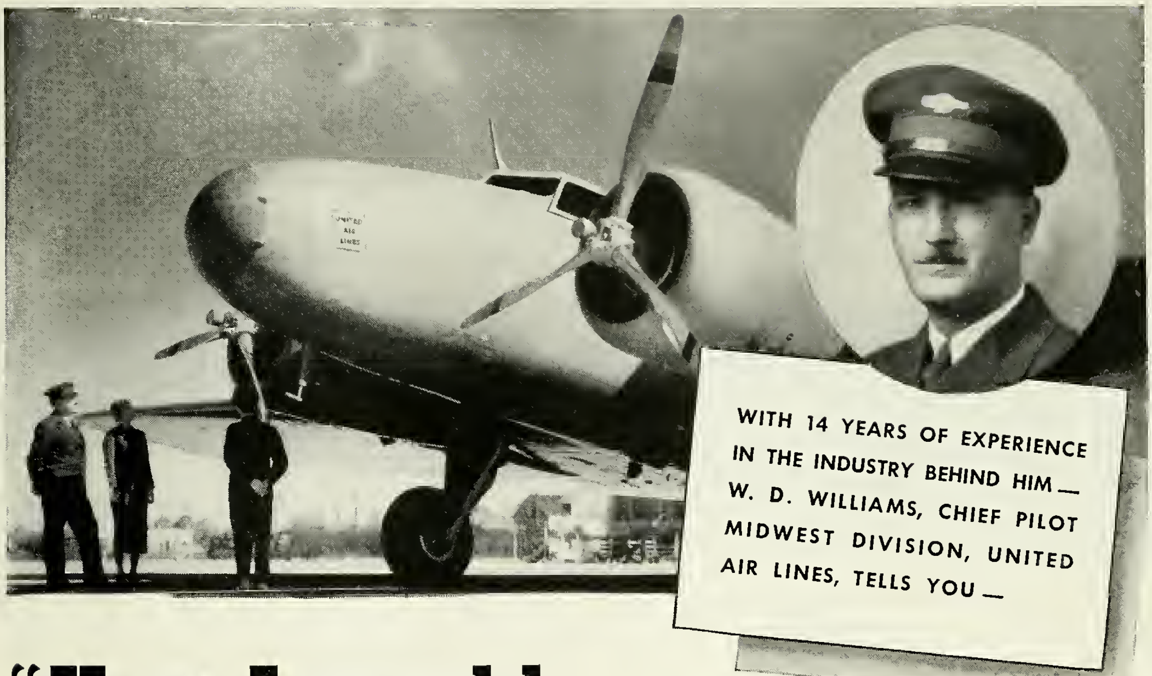


WITH 14 YEARS OF EXPERIENCE
IN THE INDUSTRY BEHIND HIM—
W. D. WILLIAMS, CHIEF PILOT
MIDWEST DIVISION, UNITED
AIR LINES, TELLS YOU—

"How I would choose my aviation school—"

"If I were a young man today, how would I go about picking my school? Well, here are the things I would want to know:

"Has it a 'playboy flying school' reputation—or is it known for long hours of intensive, serious work?

"What equipment will I actually *work with—in terms of school-owned ships (and their actual horse power), technical library, laboratories and shops?*

"Who are the men I will actually *study under?*

"Is school operated by an actual airline?

"What are its graduates doing?

"How does the U. S. Government rate the school?

"Does it lure students by promising 'to place graduates;' or are they attracted by the type of training that gives a definite edge in the competition for jobs?"

Every serious-minded man interested in aviation training will demand the answers to these seven questions from every school he is considering. To borrow or take from savings a sum upwards from $700 is a serious matter. To invest, in addition, many months of a young man's career is a serious matter. Therefore look, and look carefully, before you decide.

The Boeing 40-B (525 h. p. P & W Hornet) is used by Boeing students for landing beam instruction

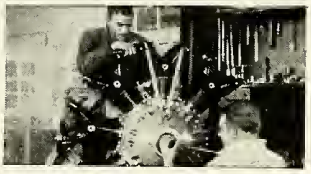
Boeing School of Aeronautics will gladly send you its answers to these vital questions. And will answer, frankly and promptly, any others you may wish to ask.

Write for complete description of Boeing School, enrollment requirements, rates and details of monthly payment plan. Mail coupon today for your copy.

BOEING SCHOOL OF AERONAUTICS

DIVISION OF UNITED AIR LINES

It's no coincidence United Air Lines' hangars at Oakland, Calif., adjoin Boeing School's. A part of United Air Lines, the school draws upon the world's largest air transport company for practical instructions



Students assembling a Pratt & Whitney 525 h. p. One of 14 different types thoroughly learned

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- ☐ Boeing Airline Pilot
- ☐ Transport Pilot
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- ☐ Airline Mechanic
- ☐ Airline Operations
- ☐ Airline Technician (Open to Engineering graduates)
- ☐ Airline Pilot and Operations
- ☐ Special Airline Pilot (For Transport Pilots only)
- ☐ Amateur Pilot

Name__________ Age______

Years in High School______ Years in College______ Phone______

Address______ City______ State______

(*Continued from preceding page*)

that aircraft have been able to render as a result. The extent of such governmental research work should be increased to substantially above its present level as rapidly as the personnel can be trained and special laboratories equipped.

The National Advisory Committee for Aeronautics should have a moderate appropriation specifically ear-marked for the support of approved research projects at universities and other semi-public institutions which have competent staff and proper equipment to perform the work, and should be authorized to contract for the conduct of such researches and to publish the results.

General Governmental Organization

There should be created an additional Assistant Secretaryship of Commerce especially qualified to supervise the responsibilities of the Department under the Air Commerce Act. Ultimately the duties of this office might well include the supervision of the Department's functions with regard to other forms of transportation.

The Bureau of Air Commerce should be definitely recognized as a purely professional and technical organization, and its personnel, including division heads, should have a high degree of security of tenure.

The Weather Bureau should be transferred to the Department of Commerce.

Authority should be given to detail certain members of the Weather Bureau's organization for training at government expense in new methods of weather forecasting.

Aeronautical Law

If the several states do not adopt substantially uniform aeronautical regulatory laws within a reasonably early time, a Federal constitutional amendment should be adopted which will give to the Federal government exclusive control of all phases of civil aeronautics within the United States.

The United States should participate actively in the codification of international private air law, with annual appropriations therefor as necessary.

The commission hereinafter proposed should undertake a careful study of the subject of international public air navigation agreements to determine the desirable extent, if any, of American participation therein.

One or more specialists on aeronautical matters should be attached to all American delegations to international conferences having aeronautical topics on the agenda.

The application of general legal principles to matters specifically aeronautical should be modified as experience has shown to be wise, and in particular there should be provisions for Federal recording of title to aircraft and of mortgages and other liens.

Air Commerce Commission

There should be created an air commerce commission, its members appointed by the President by and with the consent of the Senate for long terms. The commission so created should have broad supervisory and regulatory powers over civil aeronautics, and particularly over domestic and foreign air transport. It should have all powers necessary to the attainment of its general supervisory and regulatory purposes, including the power to hold hearings and conduct investigations upon any subject pertaining to civil aeronautics. It should be subject to merger by executive order at any time with any other body of a similar nature having similar functions.

* * *

Inasmuch as the greatest portion of the report was confined to air transport, excerpts from the discussion of the recommendations are presented herewith.

Following a brief history of the development of air transport, the commission, in recommending that the government maintain world leadership and to lend financial aid to insure the application of most modern and efficient equipment on domestic and foreign airlines, said " . . . Studying the record, we have had no difficulty in arriving at a united conviction that the American air lines as now constituted render a highly useful public service and that they should be maintained and kept upon a high plane of efficiency and of performance.

"If we had limited our attention to the tabulation of current operating figures alone, it would have appeared that a problem hardly existed. . . . But when we proceeded to examine the financial structure that underlies the operation and makes its continuance possible, any such illusion was dispelled.

"From all that we have been able to learn of unit costs, and from the experience of air transport operators all over the world, it appears that the cost of running an airline depends principally upon the size and power of the airplanes used and upon the frequency of the schedules. With the largest and most modern craft now commonly used in domestic service carrying from 10 to 15 passengers, total operating costs appear to run from around 55 cents per mile flown when there are many schedules each day up to 75 or more when there are but one or two and the unit overhead is correspondingly high. Of the twelve contract routes using such equipment almost exclusively, there were only seven that showed in October (the last month for which figures complete in all respects were obtainable at the time of making the study) average gross revenues as high as 50 cents a mile on all the mileage flown, and only three that exceeded 60 cents. One route on which the average costs could hardly have been less than 60 cents a mile showed gross revenues of 39 cents. We believe that October may be taken as a fairly typical month, and that the figures just given may be taken as roughly representative of conditions as now indicated for the nation's transport system on a year-round average.

"There are of course many routes on which the use of such large and high-powered airplanes would be unjustified. Feeder routes in many cases permit the use of equipment that may possibly be operated, at the scale of pilot pay fixed by recent Post Office interpretations of National Labor Board ruling, for as little as 25 to 30 cents a mile. It would appear that costs can hardly go below that level without sacrifice of safety unless all pretense of maintaining a general transport service be abandoned and planes having no passenger accommodation and carrying mail alone be used, or unless advantage be taken of fortuitous opportunity to buy equipment second-hand at junk prices in a distress sale. Neither alternative commending itself to us as a desirable one, the estimate of 25 to 30 cents a mile for minimum operating cost is the lowest that we could feel justified in using. It is then disturbing to find one contractor showing gross revenues from all sources in October of 17 cents per mile, while eight were running below 30 cents.

"In the financial figures submitted by the airlines to the Interstate Commerce Commission, 26 out of 32 domestic contracts then in force showed a net loss for October. In one case the loss on a single contract amounted to almost $49,000 for the month. The total net losses of all operators, considering the whole domestic transport system as a unit, were reported as $307,000.

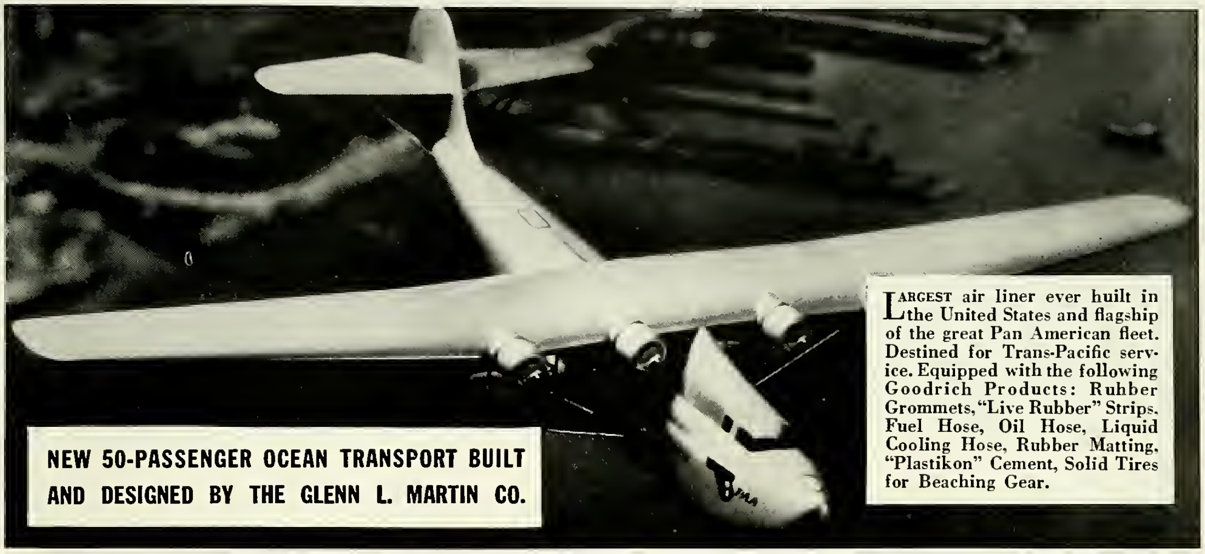
" . . . It appears, in short, that financial disaster is in the making for a large part of the present air transport system. Whether it makes its appearance in six weeks or six months or longer, we cannot see how it can be postponed indefinitely.

" . . . The general rule remains, in all parts of the world, that high-quality air transport service under present conditions does not exist without direct governmental contributions to its maintenance. The extent to which governmental aid is required to keep up a proper service steadily diminishes, but it is plain that the time has not yet come when it can be extinguished. In recommending that the American air transport system be maintained in a state to warrant our pride as citizens and to deserve our confidence as patrons, we recommend as a necessary corollary the granting of finan-

(*Continued on page 75*)

GOODRICH SCORES AGAIN!

NEW 50-PASSENGER MARTIN OCEAN TRANSPORT CHRISTENED FOR PAN AMERICAN AIRWAYS — EQUIPPED WITH GOODRICH AIRPLANE PRODUCTS FOR SAFETY



NEW 50-PASSENGER OCEAN TRANSPORT BUILT AND DESIGNED BY THE GLENN L. MARTIN CO.

LARGEST air liner ever built in the United States and flagship of the great Pan American fleet. Destined for Trans-Pacific service. Equipped with the following Goodrich Products: Rubber Grommets, "Live Rubber" Strips, Fuel Hose, Oil Hose, Liquid Cooling Hose, Rubber Matting, "Plastikon" Cement, Solid Tires for Beaching Gear.

MARTIN engineers knew what a tough assignment Pan American Airways had planned for this plane. Trans-ocean service —"hops" thousands of miles long—called for more than ordinary designing, demanded a lot more strength and dependability in the materials used.

GOODRICH WINS ON PAST RECORD

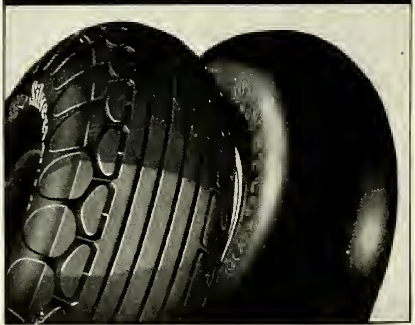
Two years ago . . . when this 50-passenger plane was only a set of blue prints . . . Martin designers knew that Goodrich airplane products would "measure up" to what was expected of them in this bigger job. They knew it from the past records of Goodrich safety and dependability.

GOODRICH FOR SAFETY

Goodrich Hose . . . Goodrich Rubber Grommets . . . Goodrich Rubber Matting and other rubber parts were written into the specifications early. They hold strategic positions in the faultless design and construction . . . the last word in precautions that insure safety to Pan American passengers and cargo during the long over-ocean stretches.

Why not give your planes the extra safety — the extra dependability — of Goodrich-made airplane products? Remember, there are over 40 Goodrich rubber products for airplanes. Don't delay. See your nearest Goodrich dealer, or write Dept. 456, Aeronautical Division of the B. F. Goodrich Co., Akron, O., for complete information.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS



Look at these big, husky Goodrich Airplane Silvertowns! Years of hard service on every type of plane . . . at airports of every description . . . have proved them safer for all landings and take-offs. The "first choice" of pilots, plane makers and air lines clear around the world.

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes—including Tires—Tail Wheels—Abrasion Shoes—De-Icers—Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete line of Rubber Aeronautical Accessories.

THE AIR SERVICES

More Military Craft Purchased

ADDITIONAL PURCHASES of aircraft for the military services involved the expenditure of $2,559,538, not including engines or spares.

Seversky Aircraft Corp., Farmingdale, N. Y., was awarded a $754,738 War Department contract for 35 basic trainers. These planes are two-place, low-wing monoplanes powered by 350 h.p. or 440 h.p. Wright Whirlwind engines and are expected to cruise at about 185 m.p.h.

The Bureau of Aeronautics ordered 84 scout-bombers from the Chance Vought Corp., of E. Hartford, Conn., for replacements in the Naval Air Service. The contract was for $1,804,800.

These planes are biplanes. Fabric-covered structure has been used throughout except in the tail surfaces which are sheet-metal covered. Split flaps are used and streamlining has been improved by an enclosed cockpit, wing and tail fillets, elimination of external tail bracing and concealment of the usual interaileron struts. In addition, the cowl housing the 700 h.p. P. & W. Twin-Wasp Junior, is the new NACA type with adjustable trailing flaps. A Hamilton Standard controllable-pitch propeller is also provided.

The Voughts are to operate from the decks of aircraft carriers and will be known as SBU-1.

Army To Give Appointments

FOR THE first time since 1930, the War Department is receiving applications for appointment to the Air Corps of officers from civilian ranks.

From 30 to 40 second lieutenants are expected to be named through preliminary examinations February 20 and final examinations April 2. Reserve officers, under 27 years of age, who have served a year on active duty as pilots with the Air Corps and who are qualified pilots, are eligible.

Winter Maneuvers Planned

ARMY AND Navy aviation personnel are to receive training in cold weather operations, according to the War and Navy Departments.

Major Ralph Royce is to command a picked squadron of eighteen pursuit, attack, bombardment, observation and transport planes at a base near Duluth where various test flights will be conducted. The flight will be made primarily to test equipment while operating under sub-zero temperature conditions.

The U.S.S. *Ranger* is being sent to waters off the coast of Maine to determine how its 72 planes function in cold weather and to discover how cold weather affects aircraft.

NAVY PATROL PLANE FLIES 2000 MILES

THE NEW Navy XP2H-1, largest patrol plane for the Naval Air Service completed a 2000-mile non-stop flight from Norfolk, Va., to Coco Solo, C. Z., in 25 hours. Lieut. J. S. Thatch piloted the craft which is powered by four Curtiss-Conqueror engines and which has a cruising range exceeding 4000 miles.

Chanute Improvements Sought

THE COMMITTEE of Military Affairs is considering a bill introduced by Congressman D. C. Dobbins calling for an expenditure of $5,205,500 for construction and improvements at Chanute Field, Rantoul, Ill.

The bill calls for $955,000 for barracks; $417,000 for non-commissioned officers' and $1,012,000 for commissioned officers' quarters; $345,000 for hangars; $30,000 for concrete aprons; $748,500 for a central heating plant; $101,000 for improving the landing area; and $400,000 for a mechanics' school and test stands. Numerous other improvements are provided for in the bill.

Parachuters Finish Training

A GROUP of 22 enlisted men was graduated from the Parachute School, Naval Air Station, Lakehurst, N. J., when they completed a 3-month course. The course consists of instruction in repair, maintenance and packing of 'chutes as well as in free and pull-off jumps from airships and airplanes.

Coast Guard Base Dedicated

THE NEW $300,000 aviation base for the U. S. Coast Guard at Biloxi, Miss., was dedicated, but not officially opened. Operations are expected to get under way this month when two amphibions will begin patrol flying from the station.

Honolulu-Manila Flight Considered

TENTATIVE PLANS have been drawn for a proposed, but as yet unsanctioned, training flight during the coming summer of a squadron of U. S. Navy patrol planes from the Hawaiian to the Philippine islands.

Ranking officers pointed out that, if ordered, the flight would be solely in the nature of a training venture. Consolidated patrol boats, similar to those which flew across the Pacific to Hawaii almost a year ago, may be used.

Admiral Joseph K. Reeves, Commander-in-Chief of the United States Fleet, is now studying and considering the proposal and will submit his recommendation or refusal to the Navy Department.

Navy Buys Douglas Transports

THE FIRST of three Douglas airliners recently purchased by the U. S. Navy was delivered to the Naval Air Station, Anacostia, D. C., where it will be used for administrative purposes. The other two will be delivered to Aircraft One, Fleet Marine Force, Quantico, Va., and to the San Diego Naval Air Station.

With the exception of distinctive markings, the planes are similar to those used in commercial operations, being powered by Wright Cyclone engines.

Baker Heads Arkansas Unit

CAPT. ROBERT H. Baker, 154th Observation Squadron, Arkansas National Guard, has been named operations officer of the squadron in charge of all activities, succeeding Capt. Robert W. Chrisp, who was appointed executive officer. Announcement of the appointments was made by Maj. Adrian Williamson, commanding officer, who also revealed the appointment of Lieut. John D. Howe as engineering officer, Capt. Baker's former post.

New Planes for Missouri Unit

THE 35TH Division Aviation, Missouri National Guard, has been allotted four new Douglas observation planes. Two planes of the 038-E type have been received and two more of the same type will be delivered this month. The new planes will supplement the present equipment of two 038-E planes and two 038-B ships, and the two 02-H's will be retired.

STANAVO
AVIATION GASOLINE
AVIATION ENGINE OIL
ROCKER ARM GREASE

RECOGNIZED

All over the world you'll find Corsairs
on duty - in steadily increasing numbers

CHANCE VOUGHT CORPORATION

SUBSIDIARY OF UNITED AIRCRAFT CORPORATION

DR. ALEXANDER KLEMIN
GLENN D. ANGLE

AVIATION ENGINEERING

DR. MICHAEL WATTER
DR. MAX MUNK

Notes on the Problems and Progress of Gyroplanes

ALEXANDER KLEMIN
Daniel Guggenheim School of Aeronautics, New York University

Original wingless Gyroplane made in Germany in 1926

● With the recent practical demonstrations of the wingless Autogiro, and revival of interest in the rotary airfoil type of aircraft, a review of the history and possibilities of another machine of this classification—the Wilford Gyroplane—seems appropriate at this time.

The Gyroplane had its inception about 1922 when Walter Riesler, a German flier, saw his brother perish in a spin which followed a sharp bank in a somewhat underpowered machine. Riesler then determined that a rotating wing machine was the best answer to the dangers of the spin. His first machine was built with a free feathering rotor, without wings, ailerons or rotor control, but due to absence of control it came to an untimely end in 1926. Progress was slow and experimentation was hampered by lack of funds. Fortunately, in 1928 E. Burke Wilford met Riesler and one of the latter's associates, Kreiser, resulting in the development in this country of the WRK Gyro, known as the Wilford Gyroplane. Wind tunnel tests were followed by construction, at the Aeromarine plant in Keyport, N. J., of the first wingless machine built in the United States and an attempt at variable blade restraint as a means of control. The first Gyroplane to fly was provided with fixed wings in addition to the rotor and was tested at the Paoli Airport in Pennsylvania, in 1931 by Frank Brown, USNR. Some ten hours of test flying were accomplished in 1932 by Paul Hovgaard. These flights were made possible by mechanical feathering for equalization of lift and for lateral and longitudinal control. Much work has since been done on the improvement of the hub, streamlining of the pylon, and in the development of a more efficient blade structure. In the summer of 1934, the WKR Gyro in the same condition as flown in 1932 was used for investigation of the amount of feathering required for stable flight. This investigation was successfully conducted in a month of intermittent flying by Joseph McCormick. Unfortunately he was later killed in an accident

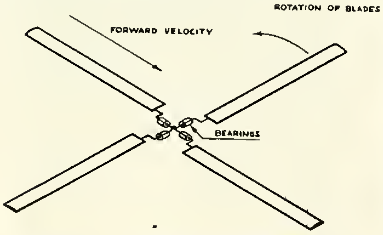
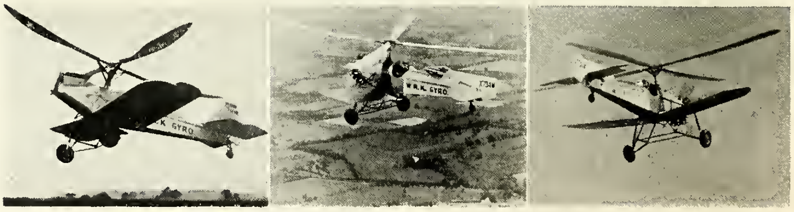
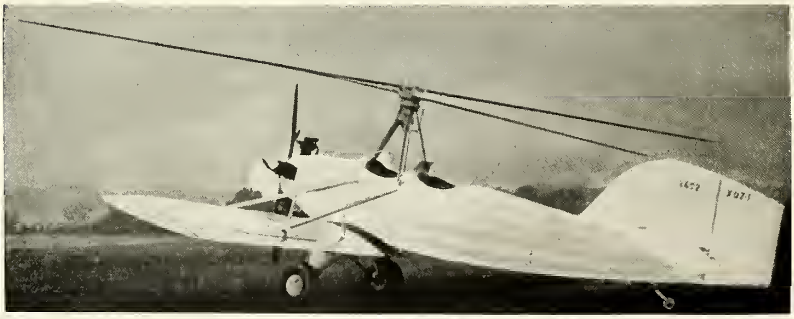


Fig. 1. Principle of the Gyroplane



Progressive types of Gyroplanes built in 1931, 1932 and 1933



Latest type of Wilford Gyroplane for military use

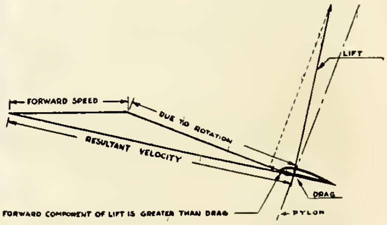


Fig. 2. Diagram of autorotative couple

The wingless Gyroplane constructed in 1930

Table 1—Characteristics of Various Gyroplane Rotors

Blade Section	Incidence of Blades (degrees)	Solidity Ratio	K_y max. referred to disc area	L/Dmax
USA 35B	0	.141	.0032	4.1
RAF 34	0	.118	.0022	4.2
RAF 34	2	.118	.0031	8.20
NACA 2418	1	.095	.0025	5.70
NACA 2418	2	.095	.0028	4.13
NACA 2418	3	.095	.0027	——

Note: For NACA 2418 at 90° incidence the drag coefficient (K_x) was .0049. At 1° the K_x minimum (referred to disc area) in idling condition was .0000075.

due to breakage (through crystallization) of the main rotor shaft.

Mr. Wilford and his associates have made steady progress, and although considerable engineering refinement is still necessary, the work they have already accomplished has established future possibilities of the Gyroplane.

The diagram of fig. 1 will recall the fundamental principle of the Gyroplane. The system rotates about a substantially vertical shaft or pylon, with opposed blade elements interconnected, and having a limited degree of freedom about axes substantially parallel to their span. If the axis of feathering of the blade elements is placed ahead of the center of pressure, each blade experiences a moment tending to diminish its pitch or angle of incidence. The blade going into the wind is subjected to a higher resultant wind velocity and exercises a greater moment about the common feathering axis than the blade receding from the wind. The blade going into the wind tends therefore to diminish its angle of incidence, while the blade receding from the forward wing experiences an increase in its angle of incidence. Thus, there is equalization of moment about a diameter of the rotor disc.

The autorotation of the Gyroplane may be explained in a similarly elementary fashion. If the pylon is backwardly inclined, so that the plane of rotation is at an angle of attack to the flight path, then, just as in any gyro, the blade going into the wind meets a resultant air velocity which makes a smaller angle with the horizontal than the plane of rotation. It is then clear (as shown in fig. 2) that the lift on the blade slopes forward of the axis of rotation, and an autorotative couple is produced.

In its early embodiment, the Gyroplane blades were restrained from excessive oscillation by springs or stops, but the process of feathering and moment equalization was a free or natural one. The free feathering Gyroplane rotor was, however soon transformed into a mechanically feathering rotor, in which the oscillation of the blades was predetermined for each point of the circular path as illustrated in fig. 3. At the same time, control was accomplished by movement of the conventional control stick through a mechanism shown in its elementary form in fig. 3. In this diagram 1 is the common blade spar of a pair of interconnected blades 2R and 2L. Levers 3, vertical links 4, bell cranks 5 and horizontal links 6, are mounted in the hub and revolve with it. The ball 7 and levers 8 are mounted on a fixed tube and do not revolve; the wires 9 which run inside the fixed tube connect the levers 8 to the bell crank 10 and arms 11 which are operated by the stick 12 through push rod 13 and torque tube 14 respectively.

The control moment obtainable from the system can be made as powerful as desired and is of the same value throughout the speed range. Further, the forces on the stick are small since the axis of feathering is close to the center of lift and the angle of blade movement required is less than 5°. The conventional fixed wing airplane has controls which are designed to give a sufficient control moment at the lowest speed. At high speeds, the airplane controls are excessively powerful and it is this excess of control which enables the pilot to stunt the plane and so impose on its structure the severe stresses which in turn necessitate high design or load factors.

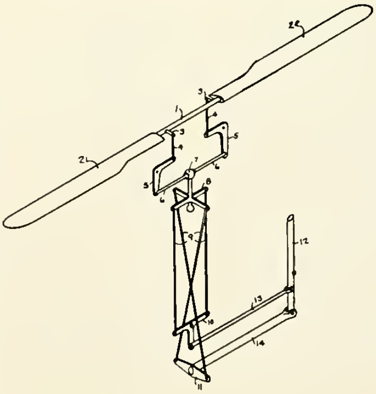


Fig. 3. Elementary form of control

The aerodynamic characteristics of the Gyroplane rotor are well adapted to slow speed and slow, short landings. It is not as well adapted as the airplane wing to the attainment of high speed or cruising efficiency. The Gyroplane also gives high lifts in vertical descent, and with the advent of rotor control, makes vertical descent (at least to within a short distance from the ground) entirely practicable.

In table 1 are summarized the aerodynamic characteristics of the rotor from a number of wind tunnel tests made at New York University. The following points are noteworthy:

Lift: At about 30° incidence for the plane of rotation, the lift coefficient of the rotor has its maximum value. A rotor has a maximum lift coefficient referred to the disc area of the same order of magnitude as an airfoil referred to its static area.

Drag: The drag is equal to the lift at about 42° incidence and increases considerably up to 90° where it becomes the lift or sustaining force. Its value at 90° is approximately equal per sq. ft. of swept disc area to the lift coefficient referred to static area of a wing provided with a lift increase device. The minimum drag of the rotor occurs at zero incidence when the rotor is idling.

Lift/Drag Ratio: The maximum *L/D* at the present time is about 8 and occurs at about 3 or 4° incidence of the disc, where the lift is about 1/10 of maximum lift at 30°. The *L/D* at maximum lift at 30° is about 2, allowing a steep flight path in landing.

While the lift (measured as a force normal to the wind) drops off after 30°, the thrust (or force normal to the disc) rises continuously to 90°, so that the rotor is fundamentally unstallable.

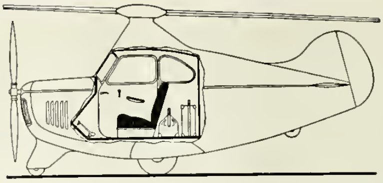
The rotative speed of a rotor depends more on loading than speed and therefore for a given ship is nearly constant throughout the speed range. With present loadings and pitch angles the tip speeds are generally from 200 to 300 m.p.h.

There are, in the Gyroplane, two distinct régimes of rotation. One is autorotation, previously described, in which a forward component of lift on the advancing blade provides an autorotative couple. The other is an "idling" condition in which the angle of the plane of rotation is so small that practically no lift is developed by the rotor. It may be asked why there should be rotation at all at idling speeds. At idling speeds the rotational velocity is so slow, that the ratio of forward speed to rotational tip speed is of the order of 3.

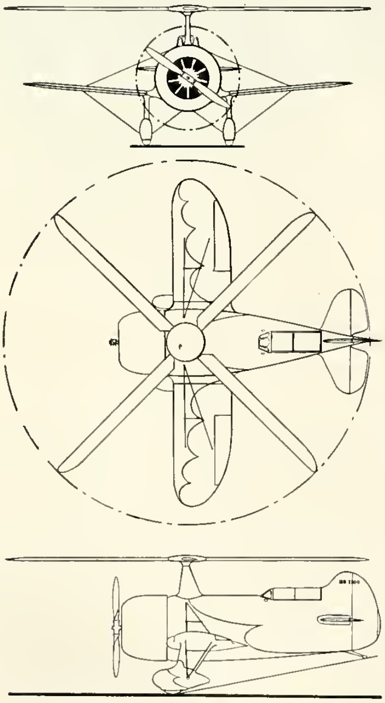
In such a case the resultant wind on the blade on the advancing side is from ahead. The advancing blade is then offering its leading edge to the resultant wind, while the receding blade is at the same time offering its trailing edge to the resultant wind. The drag of the receding blade is then higher than that of the advancing blade and a slow, rotary idling motion is maintained.

In this idling condition, with the rotor carrying no lift, it is conceivable that the drag should be low. Tests made on a 42" rotor, with zero feathering, and with pitch setting of 1° showed the drag coefficient of the idling rotor referred to blade area to be 2.5 times the minimum drag of the blade profile under static test.

By unloading the rotor, high speed could be improved. The plan is to so arrange the incidence of the fixed wing that with the rotor unloaded, the fixed wing would be working at its best *L/D* ratio, while at the same time the rotor would be operating at its low or idling drag.



Sectional view of cabin Gyroplane design



Racing Gyroplane design by Granville

While the calculations made to check this theory are quite rudimentary they indicate that the idea should be investigated further with a view to improvement in high speed, which remains one of the vital problems of rotary wing aircraft.

In discussions of the Gyroplane the objection is sometimes made that there are structural difficulties, as the rotor takes all stresses in bending. Such a view is no more justified than the view that a thin metal propeller must be strong enough to take all the thrust loads in bending. In the thin metal propeller, any deflection of the blade is immediately followed by the so-called "centrifugal relief" the centrifugal force on the blade tending to offset the thrust bending moment as soon as there is any deflection. By means of this centrifugal relief, surprisingly thin metal propeller blades have been successfully employed. In the same way, if the Gyroplane is skillfully designed, there is no doubt that it can be made partially flexible with similar benefits to those in the case of the propeller. The only limitation on flexibility is the necessity of clearing the tail surfaces as in landing or taxying.

Another difficulty is that of the gyroscopic forces and couples. Gyroscopic forces are merely forces due to acceleration. With a flapping blade, the rotor adjusts itself to gyroscopic forces, since no bending moments can be transmitted to the hinge. In the Wilford rotor no such immediate adjustment is possible. The gyroscopic forces are of course induced either by banking or pitching. A study of gyroscopic effects is therefore an integral part of the development. It should be noted, however, that:

1. The Gyro is not intended for violent maneuver such as acrobatics. The control system can be adjusted to make such impossible.

2. A bank may be accompanied by some anticipatory control in pitch by special arrangement of the control system thereby anticipating the gyroscopic moments and forces.

3. Since the blades should be semi-flexible (and only rigid to the extent that a drooping blade should clear the tail surfaces) the effect of gyroscopic forces should be minimized in the same way that bending moments due to lift loads are minimized.

It should be noted also that owing to the approximate symmetry of the system, dynamic unbalance is not to be feared.

This article is neither intended to be a discussion of the respective merits of the Gyro and the airplane, or of the Autogirc and the Gyroplane, or is it an authoritative study of the Gyroplane. It serves as a series of notes to elicit further thought on the subject, and the following conclusions seem to emerge.

1. Structural problems need the most careful study, though they are by no means insuperable.
2. The rotor control system is very promising and very valuable.
3. The possibility of unloading the rotor is well worth further study.
4. There are decided possibilities in the use of a rotor without fixed wing for slow machines and the use of a smaller rotor with fixed wing for higher speeds.
5. Super autorotative speed by application of a moderate amount of power is well worth further investigation for improvement of climb and take-off.
6. It is evident, considering the relatively short period of time that the Gyroplane has been under active development, and the relatively small expenditures it has involved, and considering the definite promise it has given, that it is decidedly worthy of further effort.

Rotor details of latest Gyroplane

The Curtiss-Wright Condor as a Freighter

● The Curtiss-Wright Airplane Co. has redesigned the conventional Condor biplane into a general purpose cargo and freight carrier, and has arranged the plane so that it can be adapted for carrying troops, general freight, spare engines, parts, cafeteria equipment or regular passengers. In addition, the interior can be equipped as an ambulance.

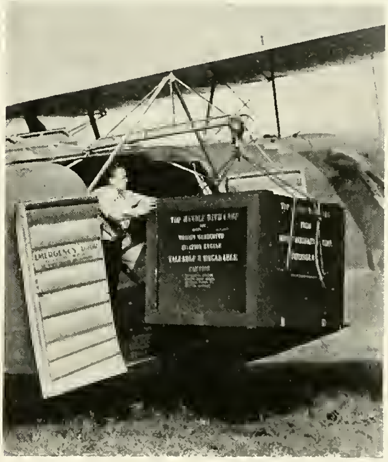
Known as the Model CT-32, this twin Wright Cyclone-powered transport is equipped with the necessary accessories for loading, unloading and storing cargo, and its detail design has been simplified to reduce maintenance and repair.

As a freight carrier a monorail hoist (capable of lifting a 1000-lb. load from the ground), loading ramp, removable rear floor, block and tackle and hold-down eyes are provided. The hoist consists of a rope-driven screw hoist and trolley which runs on an aluminum alloy *I* beam, supported over the door by two diagonal steel tubes with welded fittings. Attachment is made at the ridge pole on the center line of the door by a screw fitting. The track can be disassembled by unscrewing this fitting, and can be stored aft of the cabin with its supports in brackets provided for it. A removable section of flooring brings the door-sill level when the tail of the ship is on the ground. Two channel sections provide a ramp on which standard engine dollies can be rolled aboard the ship. For moving heavy freight forward in the ship, with the tail down, a block and tackle is provided. Fittings in the floor provide anchorage for standard engine dollies.

Standard cabin furnishings include 10 pyralin windows of 12½" diameter; a main entrance door; two emergency exit doors, one on either side of the cabin centrally located; a hatch in the pilots' compartment for fueling and servicing; a hatch aft of the cabin in the floor for parachute exit and the dropping of food and other items in containers by parachute; a first aid kit; a lavatory; a complete cabin heating installation with 12 individually controlled outlets; and two cabin dome lights which include air exhaust ventilating units.

The interior dimension of the fuselage available for cargo is 22 ft. × 6 ft. 6 in. × 6 ft. 3 in. with a main cabin door constructed of aluminum alloy sheet, and with a similarly constructed hatch making available a clear opening of 6 ft. 6 in. in height, and 6 ft. in width.

The fuselage is constructed of welded 4130 steel tubing. Five longerons (2 lower, one right, one left upper, and one center) are used in the region of the cabin, the upper right hand unit being omitted at the cargo door. A rigid arch is trussed in the plane of the front wing beams, behind and ahead of the cargo door. The cabin floor structure is fabricated from aluminum alloy stringers and arches riveted into sections which attach to clips on the lower longerons and the keel, which runs longitudinally under the center of the cabin compartment. The metal floor structure is covered with 3/16" birch plywood. The pilots' compartment floor consists of an aluminum alloy corrugated section covered with a flat aluminum alloy plate, bolted to the supporting structure.



Hoisting a boxed engine aboard the Condor

The balance of the airplane, including the wing group, tail group, engine nacelle and cowl, landing gear, etc., are of conventional Condor transport construction.

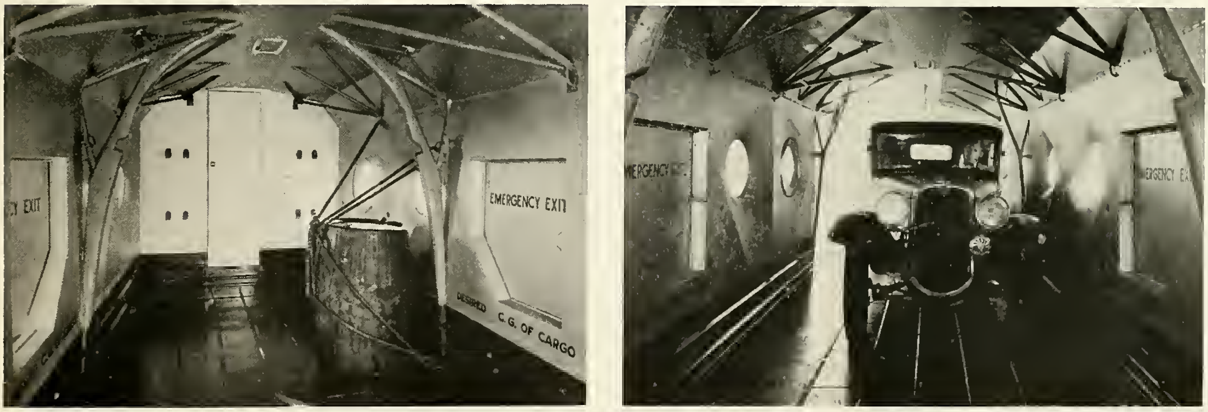
The basic crew arrangement consists of two pilots; standard airline navigational facilities and engine instruments are provided, including blind flying instruments and two-way radio installation.

The two 750 horsepower R-1820-25 Wright Cyclone engines are driven by Hamilton-Standard propellers of the three-bladed controllable-pitch type.

When used as a troop transport, four folding benches, seating 16 soldiers, are carried, with ample space remaining for packs, rifles and equipment; as an ambulance ship, three welded steel litters on each side of the cabin are provided aft, leaving the remainder of the cabin clear for other personnel or equipment; and as a cafeteria there is ample room for any desired kitchen equipment.

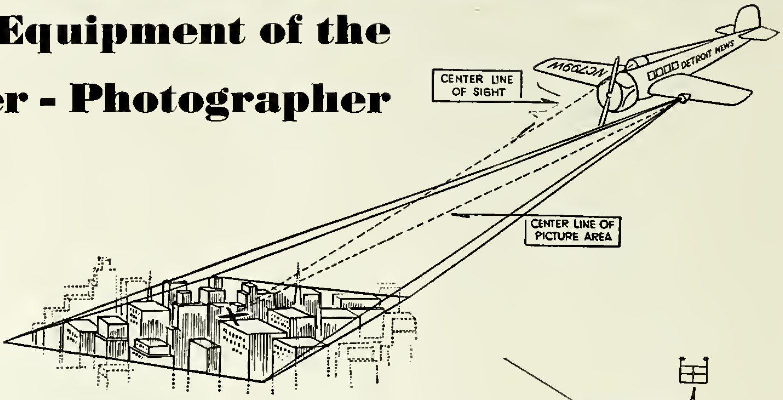
Specifications and performance of the Curtiss-Wright Condor Cargo Carrier are as follows:

Wing span, upper	82 feet
Wing span, lower	74 feet
Length overall	49 feet 7 inches
Height overall	16 feet 7 inches
Weight empty	11,762 pounds
Useful load	6,738 pounds
Gross weight	18,500 pounds
Maximum speed	177 miles per hour
Landing speed (full load)	58 m.p.h.
Service ceiling	20,000 feet
Climb to 10,000 feet	10.5 minutes
Cruising range	750 miles



Looking fore and aft in the Condor Cargo Carrier showing the spaciousness of its unobstructed interior

Complete Aerial Equipment of the Modern Reporter - Photographer



● One of the most interesting adaptations of the airplane for newspaper work, is the Pratt & Whitney powered monoplane built especially for the Detroit *News*. Equipped with every modern device for flight, it is further supplied with aerial cameras, three seats, a desk for a reporter or radio operator, and a compact broadcasting station.

The plane, which was built to *The News'* specifications by the Lockheed Aircraft Corp., Burbank, Calif., and which took 15 months to pass from the design to the completed work, is a low-wing monoplane convertible into a land or seaplane. Following standard Lockheed procedure, the fuselage is of monocoque construction and of selected straight-grain spruce, 15 laminated diaphragms forming the principal fuselage structure. These are joined together with steel rods and interbraced with wood compression members. Plywood, fabric covered, forms the outer covering. Wood construction has principally been used to minimize camera vibration and background noises deterrent to broadcasting.

Aviation Editor Piersol placing film pack holder in the aerial camera installed in the wing nacelle of the Detroit News' Lockheed

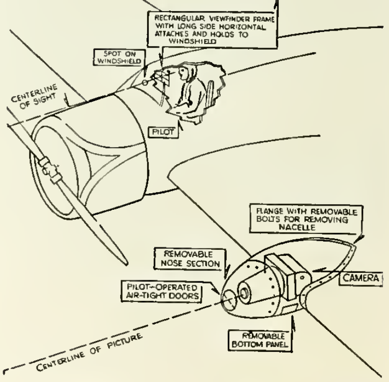
Six fuel tanks, providing sufficient capacity for a 1000-mile range, are built into the 43-foot cantilever wing. Wing flaps are flush with the under surface of the wing and are operated by an electric motor.

Blue leather has been utilized in uphostering the cabin, and chrome and wine-colored fittings give the interior a modern touch. The three seats are removable to provide space for carrying 1000 pounds of newspapers and large doors in the baggage compartment may be opened for oblique photographs.

A retractable landing gear is provided when the plane is used for land operations, the position of the gear being indicated to the pilot by visible and aural signals in the cockpit. Automatic control is obtained by the installation of a Sperry pilot, enabling the pilot to take pictures, broadcast news, write and navigate. Two small gyroscopes mounted in the control panel actuate the mechanical pilot; one unit controls the rudder and the other the ailerons.

Special equipment provides a practical method of taking aerial news pictures with an automatic camera directed and controlled by the pilot. Three camera installations make it possible to take pictures from any angle.

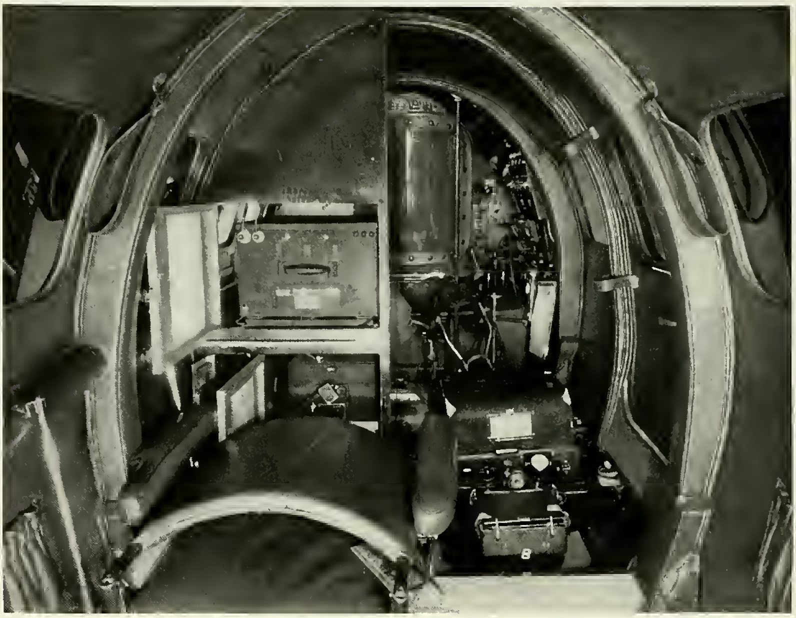
The camera used is a standard Fairchild K-3B aerial camera equipped with an Eastman F5.0 lens of 12-inch focal length. It is the latest type of general utility aerial camera now being used for both vertical and oblique photographs by the U.S. Army Air Corps and other military and commercial aerial photographic organizations in the United States and foreign countries.


RECTANGULAR VIEWFINDER FRAME WITH LONG SIDE HORIZONTAL ATTACHES AND HOLDS TO WINDSHIELD
SPOT ON WINDSHIELD
CENTERLINE OF SIGHT
PILOT
FLANGE WITH REMOVABLE BOLTS FOR REMOVING NACELLE
REMOVABLE NOSE SECTION
CAMERA
PILOT-OPERATED AIR-TIGHT DOORS
REMOVABLE BOTTOM PANEL
CENTERLINE OF PICTURE

Graphic illustration of operation and action of the wing camera

Particular interest is centered on the novel installation of the wing-camera. The conventional camera method of procedure in oblique photography is to use a hand-held, manually-operated camera and "shoot" over the side of the airplane, out a window or door of a cabin airplane. However, in *The News* plane installations, a unique method of mounting the camera in a fixed position for oblique photography has been devised and fully-automatic operation utilized.

This camera is installed in a streamlined nacelle on the left wing of the air-



Looking forward to the pilot's cockpit showing the arrangement of the radio and photographic apparatus of the Detroit News' Lockheed

plane parallel to the line of flight and the method of operation is very similar to the operation of a fixed machine-gun. The camera can be operated electrically by pressing a push button on the control stick of the airplane, the controls leading through the wing to the cockpit.

Immediately after the exposure has been made, the shutter is automatically wound and fresh film moved into position for the next picture. The complete cycle of operations requires only about three seconds. A red signal light on the instrument panel warns the pilot when the camera wind mechanism is in operation. A 75-foot role of film, 7 × 9 inches in size is used.

Precaution has been taken to assure trouble-free operation under all conditions. The camera is equipped with the Fairchild between-the-lens shutter. The enclosure which houses the camera on the wing is equipped with an adjustable lens protector to protect the filter and front of the lens assembly from precipitation while the airplane is in flight. As the airplane approaches the object to be photographed the pilot can open the cover of the lens protector by a Bowden wire arrangement located in the cockpit.

Vibration is effectively absorbed by an anti-vibration type mount.

A gun sight mounted on the pilot's windshield serves as the viewfinder. He aims the plane and it automatically aims the camera. Once in position, he presses the trigger on his control stick to make the photograph. Machine-gun accuracy is obtainable with the new sighting method. Pictures can be taken at intervals of two seconds and a total of 110 can be taken with one loading of the camera magazine.

Being a standard camera, the K-3B can be used, when the occasion demands, for vertical photography by removing it from its enclosure in the wing and placing it in a standard Fairchild vertical suspension-mount inside the cabin.

Photographs also may be taken straight down through an opening in the floor. This installation can be operated manually from the passenger compartment or automatically from the pilot's seat. The third camera installation located in one of the compartments in the rear, provides for manually operated cameras projected upward, sidewise and to the rear.

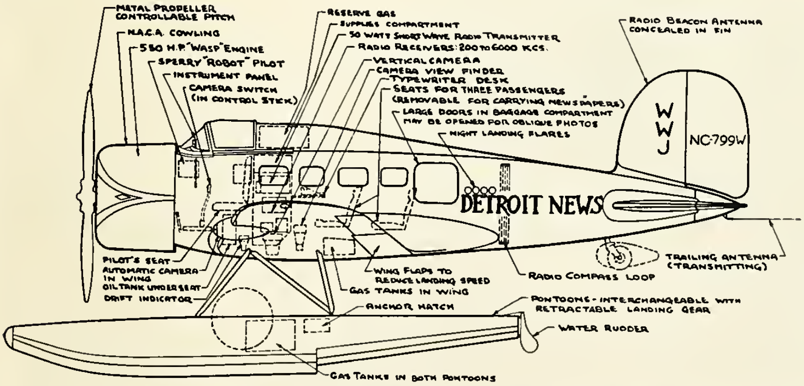
Radio equipment includes a new-type transmitter which is to be an auxiliary of WWJ, *The News'* radio station, in broadcasting outdoor events of public interest. The installation was developed by the radio station's engineers, as well as the radio technicians of American Airlines and TWA, Inc. The transmitter, which covers a range of 1000 to 6000 kilocycles was built by the Western Electric Co. It transmits both voice and code and can be operated from either the cockpit or cabin.

The radio receiving equipment covers the range of 195 to 6000 kilocycles. A special receiver includes a navigator's directional loop, provision for flying the airway range beacons and receiving Department of Commerce weather broadcasts.

Powered by a supercharged P. & W. Wasp engine of 550 h.p., and equipped with a Hamilton Standard controllable-pitch propeller, the ship has a maximum speed of 202 miles an hour at 1000 feet. With the flaps in operation, landing speed has been reduced from 80 to 65 m.p.h., and wheel brakes reduce the length of the landing run. Streamlined tires are employed to ease landing shocks. The engine drives two pumps for governing the operation of the Sperry automatic pilot and the propeller control.

James V. Piersol is aviation editor of *The News* and pilot of the plane. In keeping with the early experience of William E. Scripps, president of *The News* who in 1912 qualified for membership in the Early Birds organization by piloting the first airplane delivery of newspapers in Detroit, the plane was christened the *Early Bird.*

The News previously owned a Pratt and Whitney powered Lockheed Vega and from the record established by that plane before it was retired from service, the new craft is in for a busy time. The old plane covered routine affairs, calendar events, spot news and special assignments. Trips were made to report on local as well as national events and where news of local interest was thousands of miles away from Detroit, the plane was flown there, utilizing the time in the air to photograph points of interest along the route.


METAL PROPELLER CONTROLLABLE PITCH
N.A.C.A. COWLING
550 H.P. "WASP" ENGINE
SPERRY "ROBOT" PILOT
INSTRUMENT PANEL
CAMERA SWITCH (IN CONTROL STICK)
RESERVE GAS
SUPPLIES COMPARTMENT
50 WATT SHORT WAVE RADIO TRANSMITTER
RADIO RECEIVERS: 200 TO 6000 KCS.
VERTICAL CAMERA
CAMERA VIEW FINDER
TYPEWRITER DESK
SEATS FOR THREE PASSENGERS (REMOVABLE FOR CARRYING NEWSPAPERS)
LARGE DOORS IN BAGGAGE COMPARTMENT MAY BE OPENED FOR OBLIQUE PHOTOS
NIGHT LANDING FLARES
RADIO BEACON ANTENNA CONCEALED IN FIN
WWJ
NC-799W
DETROIT NEWS
PILOT'S SEAT
AUTOMATIC CAMERA IN WING
OIL TANK UNDER SEAT
DRIFT INDICATOR
WING FLAPS TO REDUCE LANDING SPEED
GAS TANKS IN WING
ANCHOR HATCH
RADIO COMPASS LOOP
TRAILING ANTENNA (TRANSMITTING)
PONTOONS - INTERCHANGEABLE WITH RETRACTABLE LANDING GEAR
WATER RUDDER
GAS TANKS IN BOTH PONTOONS

Diagrammatic sketch of arrangement and equipment installation

The Lanier "Vacuplane"

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EDWARD M. LANIER

● Evidencing a number of radical departures from conventional aircraft construction, the Lanier Vacuplane recently made a series of demonstration flights at the dedication of the Troy, N. Y., municipal airport.

The small plane is the result of the work of Edward H. Lanier, who in 1908 built a monoplane in Cincinnati, Ohio, and who subsequently conceived the idea of adopting the vacuum principle to aircraft for inherent stability, especially at the stalling condition.

The first of these planes, the XL1, built in 1928, was a monoplane with an open concave cell in the center section, blending into the fuselage. The wings were spaced from the fuselage to allow the air to flow against the cell. Later, three other models were built and flown, one of them being of the wingless type and employing an 85-h.p. LeBlond engine.

Availing themselves of the information gathered from the four models, the present Lanier Vacuplane was designed and built by the author's father and the author. Wind tunnel tests indicated that the concave cell maintains a practically constant center of pressure, the travel being 2% of the chord in 34°. The cell does not burble until it reaches the 34°-angle of attack.

Instead of the air flowing over the cell and creating a downwash, the air flows over the nose, or entering edge, in the conventional manner, but instead of going down, flows up before and after leaving the trailing edge of the cell.

In tests made by a number of pilots, it was found that the Vacuplane does not slip or dive in a stall. This is due to the quick evacuation of the concave cell and the distribution of the lift forces, even at low speeds. The concave cell acts as an inverted parachute and when the ship settles, the plane is self-balancing and if desired, the pilot can still maintain longitudinal and lateral control.

Take-off and climb were found to be satisfactory and the ship is stable in flight, maintaining a normal flight attitude with hands and feet off the controls. One of its characteristics is its inherent lateral stability in all flight attitudes.

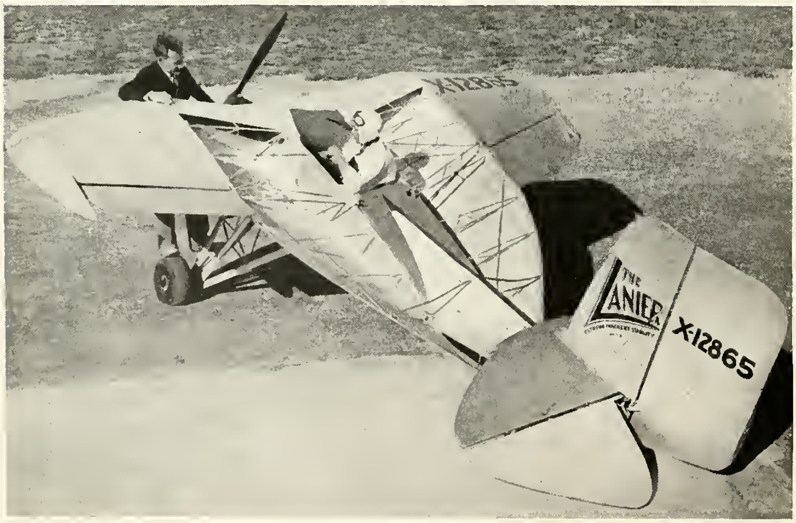
In landing, the Vacuplane indicates the desirable tendency of adhering to a steep descent, while control is maintained with little forward speed. Upon landing the plane can be brought to a stop within a short distance, allowing landings in restricted and small areas.

The engine is an Aeronca 36-horsepower horizontally-opposed cylinder type. While the original design is of chrome-molybdenum tubing covered with fabric, all-metal construction is practical and adaptable to the design. Folding wings bring the span of the plane to 8 ft. 2 in., permitting storage in a small enclosure.

Specifications and performance of the Lanier Vacuplane are as follows:

Specifications

Wing span	14 feet 4 inches
Cell span	7 feet
Lifting area (including ailerons)	73 sq. ft.
Wing loading	7.8 lbs./sq. ft.
Empty weight	350 pounds
Useful load	224 pounds
Gross weight	574 pounds
Fuel capacity	8 gallons
Maximum speed	96 miles per hour
Cruising speed	80 miles per hour
Landing speed	30 miles per hour
Take-off run	90 feet
Cruising range	250 miles
Climb (first minute)	700 feet



View showing the concave cell feature of the latest Vacuplane *Acme photo*

Recent Aeronautical Patents

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Propeller. Clinton H. Havill, South Orange, N. J., assignor to Eclipse Aviation Corp. (1,982,162)

Variable-pitch propeller. Raymond P. Lansing, Montclair, N. J., assignor to Eclipse Aviation Corp.

Wing structure. Giuseppe M. Bellanca, New Castle, Del. (1,982,242)

Variable-pitch propeller for aircraft and for ventilation, Emil A. Briner, East Orange, N. J., assignor to Aero Engineering Corp. (1,982,283)

Propeller control mechanism. Emil A. Briner, assignor to Aero Engineering Corp. (1,982,284)

Brake for airplane landing gear. Otto E. Wolff, New York, N. Y. (1,982,617)

Air-driven gyroscope. Bert G. Carison, Elmhurst, N. Y., and Herbert H. Thompson, Mountain Lakes, N. J., assignors to Sperry Gyroscope Co. (1,982,635)

Air-driven gyro vertical. Bert G. Carison, assignor to Sperry Gyroscope Co. (1,982,636)

Directional gyroscope. Bert G. Carison, assignor to Sperry Gyroscope Co. (1,982,637)

Gyro pilot for aircraft. Elmer A. Sperry, jr., Brooklyn, N. Y., assignor to Sperry Gyroscope Co. (1,982,702)

Flight recorder for aircraft. Thornton R. Rhodes, Riverside, Calif. (1,982,882)

Illuminated aerial display. Edwin A. Link, jr., Cortland, N. Y. (1,982,960)

Aircraft. Edward A. Stalker, Ann Arbor, Mich. (1,982,968 and 1,982,969)

Method and means for use in navigation. Edmund H. Hansen, Los Angeles, Calif. (1,983,079)

Magnetic compass. Clarence L. Seward, jr., Washington, D. C., assignor to Bendix Aviation Corp. (1,983,103)

Convertible aircraft. Clyde R. Harding, Council Bluffs, Iowa. (1,983,171)

Aircraft landing gear holding device. Frank W. Fink, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (1,983,358)

Method of producing motive forces on aircraft by explosion of inflammable mixtures. Paul Schmidt, Munich, Germany. (1,983,405)

Ground propulsion of aircraft. Edward A. Stalker. (1,983,493)

Propeller and method of manufacturing. Heinrich Sukohl, Berlin-Waidmannslust, Germany. (1,984,044)

Navigating instrument. Jerauld Wright, Lieutenant Commander, U.S. Navy. (1,984,390)

Airplane. Heinrich Karl, Jersey City, N. J. (1,984,584)

Gyro baseline. Mortimer F. Bates, Brooklyn, N. Y., assignor to Sperry Gyroscope Co. (1,984,859)

Gyro vertical. Reginald E. Gillmor, Forest Hills, N. Y., and Bruno A. Wittkuhns, Chatham, N. J., assignors to Sperry Gyroscope Co. (1,984,874)

Automatic variable-pitch propeller. Chandley W. Lambert, Cleveland, Ohio. (1,985,041)

Method and means for constructing aircraft structures. Jean A. Roché, Dayton, Ohio. (1,985,262)

Aircraft navigational instrument. Robert Hall Smith, Lieutenant, U. S. Navy. (1,985,265)

Aircraft navigational instrument. Robert Hall Smith and John P. W. Vest, Lieutenants, U.S. Navy. (1,985,266)

Propulsion device (propeller). Albert Vischer, Jr., Ridgewood, N. J. (1,985,391)

Retractable landing light. Lester F. Lemm, Lynwood, Calif. (1,985,611)

Construction of wings for aircraft. Barnes N. Wallis, Weybridge, England, assignor to Vickers (Aviation) Limited. (1,985,649)

Sustaining rotor for aircraft and method of making. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (1,985,819)

Time-controlled releasing mechanism (for parachute-packs). Walter C. Ellis, U.S. Army. (1,985,890)

Navigational instrument. Philip Van H. Weems, U.S. Navy. (1,985,907)

Amphibian airship. Joseph J. Leray, West Warwick, R. I. (1,986,064)

Airplane. Edward A. Marski, Phoenix, Ariz. (1,986,066)

Controllable-pitch propeller. Robert M. Stanley, Los Angeles, Calif. (1,986,229)

Aircraft machine gun camera. John P. Gaty, Woodside, N. Y., assignor to Fairchild Aerial Camera Corp. (1,986,261)

Testing apparatus for airplanes. Roy S. Sanford, South Bend, Ind., assignor to Bendix-Cowdrey Brake Tester, Inc. (1,986,605)

Flying machine having revolving supporting surfaces. Louis Breguet and Rene Dorand, Paris, France; said Dorand assignor to said Breguet. (1,986,709)

Flying Wing With a Low Aspect Ratio

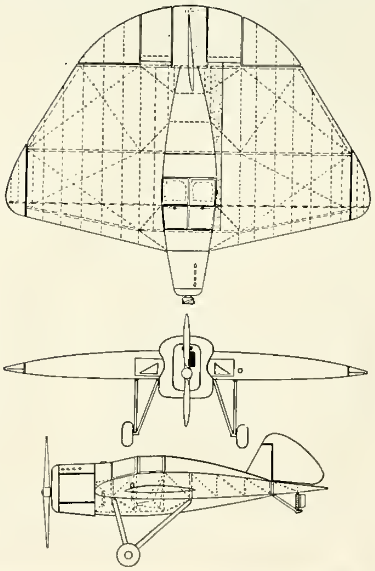
●

RAOUL J. HOFFMAN

● The all-wing airplane built in St. Petersburg, Fla., for J. Leslie Younghusband, is a low aspect ratio flying wing with a span of 22 ft. 8 in., a maximum chord of 14 ft. 6 in. and a total wing area of 237 sq. ft. Including the center section, overall length is 17 ft. 8 in., and the weight empty of 900 lbs., may be reduced by more detailed designing.

The center section fin and rudder is of welded steel tubing, and the other components are of fabric-covered spruce. Three spars are used, with double drag trussing in each bay, giving the machine rigid construction, the center spar having a depth of 20 inches. Wing sections are of the M6 type, with M1 at the tip and an extended M6 at the center. While initial tests have been conducted with a rigid landing gear, a retractable landing gear with 16 × 7 × 3 airwheels may be installed. Seats are side-by-side and dual controls and individual stabilizer adjustment are provided. The twin elevators have push and pull connections and the tip ailerons are torque-tube operated. The engine is a 85 h.p. English Cirrus with a 7-ft. diameter propeller having a 4 ft. 4 in. pitch. A Ford fuel pump insures positive feed in any position, and cooling baffles have been designed in accordance with modern laboratory tests. The tank has a capacity of 16 gallons. Entrance to the cabin is over the top of the wing.

Flight tests have shown the plane to possess characteristics of an all-wing airplane. The landing at stall angle is steep and just before the wheels touch the ground, the machine goes into a flattened glide, a behavior attributed to the positive rake of the trailing edges and the diverging airflow which is visible when idling on the ground. Lateral and directional stability is good and longitudinal stability may be improved by eliminating the dead center of the elevator control. Top speed is 135 m.p.h., take-off speed 30 m.p.h. and the landing speed 28 m.p.h.



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Outline drawings and a three-quarter rear view of Hoffman's low aspect ratio flying wing which has a speed range of 28 to 135 miles an hour

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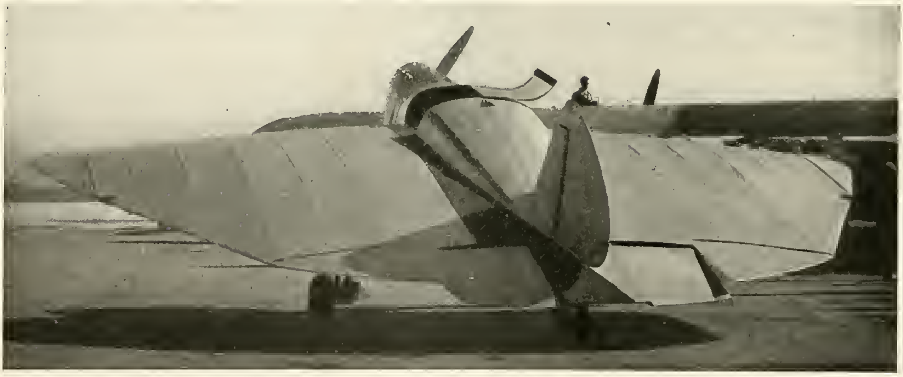


Scientific Color Application

A. FELIX duPONT, JR.

E. I. duPont de Nemours, Inc.

● The industry is contemplating the use of color on the exterior of its transport planes, and it is essential that the true meaning of the term "color" be understood in order to fully appreciate its proper application.

Color is defined in the dictionary as "any one of the hues of the rainbow or spectrum, or a tint produced by the blending of those hues." This definition is, however, from a scientific viewpoint considered insufficient and only partially correct as it lacks adequate detail. Just as music is defined by two dimensions—volume and scale, so color may be described by three dimensions—hue, value and chroma.

Methods of describing and classifying colors are ancient ones, dating back hundreds of years. The early pioneers, however, based their color classifications arbitrarily on the irregularities of dye and pigment mixtures which were too difficult to memorize or remember. Later, color scientists found that an easily understood and retainable color notation method would suit the needs of modern color users.

Helmholtz, one of the later scientists, spent considerable thought along these lines and stated that color possesses three simple dimensions or attributes which are determined directly by the eye and which have no direct relation to dye or pigment mixtures. Lacking the opportunity to illustrate how these dimensions were to be visualized and what standards to set up for developing a general color language, Helmholtz's work remained for a time buried in the archives of science.

Subsequently in 1898, Albert H. Munsell, an art instructor, utilized the possibilities opened up by Helmholtz in practical color study. He decided that the best way to bring about a popular understanding of this subject was to illustrate the three dimensions of color graphically on a color sphere. He, therefore, planned a series of color charts presenting standardized scales of hue, value and chroma, and assembled the entire series into an atlas in 1915.

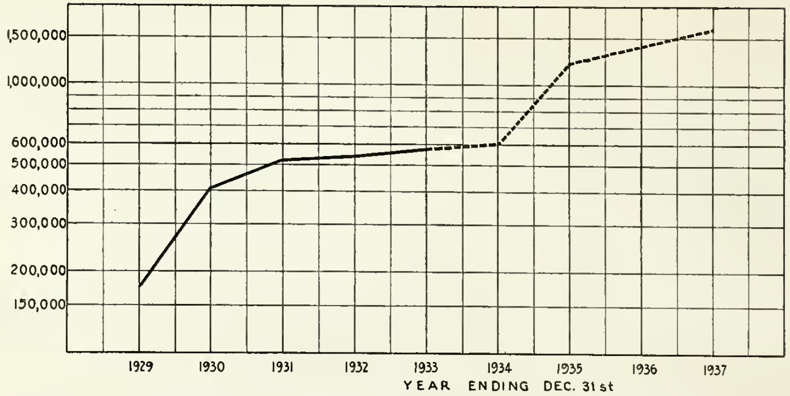
The three dimensions are described as follows:

Hue is the quality by which we distinguish one color from another, as a red from a purple, a blue, a green, or a yellow. It is the first characteristic of a color that the eye detects.

Value distinguishes for us a light color from a dark one, loosely called tints or shades.

Chroma enables us to distinguish a strong color from a weak. Fading in color usually designates loss of chroma.

Each of the above dimensions can be measured numerically, thus giving a control for application. In the diagram on the following page, the circular band represents the hues in their proper sequence. In notating a color, its hue is indicated by the initial letter or letters of the color referred to as R for red, P for purple, YG for yellow-green, etc. The upright center axis is the value scale which graduates ten steps of value from black at the bottom up to white at the top. Gray is half-way between black and white, being 5 on the scale. The paths pointing outward from the center show the steps of chroma, increasing in strength as indicated by the numerals.



Graph illustrating the number of passengers the airlines must carry

Compare the natural color of this metal transport with the colored version below

To get the best effect of colors in a picture or on an object, areas of color should all balance to give a neutral gray when visually mixed together. Naturally, some people can cultivate their eye to handle color correctly more easily than others, but we are all conscious of its use. Those who have an appreciation for color are mentally affected by it. This is more often found to be true in women than men.

It is a recognized fact that some industrial concerns have increased their sales approximately 25% by scientifically applying color. Articles displayed on counters are particularly affected. This same scientific color application is now available to the aviation business for, comparatively speaking, the airplane is a small package in the great space through which it flies.

Private airplane manufacturers have learned the value of glossy, attractive finishes on their demonstrators. They have found that the use of pleasing color combinations greatly enhances distinctiveness and salability. Without any scientific knowledge of color application, these manufacturers have applied color to their

(*Continued on following page*)

(Continued from preceding page)

merchandise with varying degrees of success. With the advent of the low-wing monoplane, great benefits may be derived from correct color use.

Due to compactness of design, the streamlined low-wing monoplane is more adaptable to scientific color application than the biplane. First, the number of square feet of surface area must be known in order to cover the proper percentages with the proper colors. Combinations of two colors are enough, although very satisfactory results can be obtained with three. Correct contrast is desirable. It is obtained by first determining the areas visible and then selecting a desirable color. The proper hue, value and chroma of the complementary color may then be calculated to be used as the second color.

It is interesting to note here the recent change in colors on service ships for the Army Air Corps. All new airplanes being purchased will have blue fuselages instead of the old brown, olive drab color, and the 93 bombers now under construction by Martin will be in sky blue and yellow *Dulux*. Although here, color will not be scientifically applied, a comparison to the non-colored transport will be apparent.

It seems quite natural that our transport lines are now considering the adoption of color. The new all-metal ships are covered with sheets of Alclad,* or anodized Duralumin,** giving a silver or gray appearance. Now that the mechanics of transportation are successful more consideration is being given to passenger appeal.

The orange yellow as used on the wings of the Martin Bomber is the most light-reflective color under all weather conditions

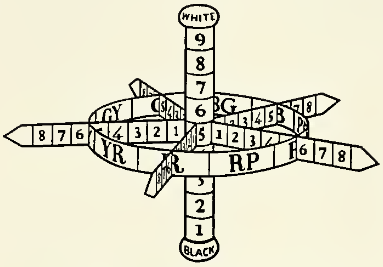


Diagram showing hue, value and chroma in their relation to one another

Certainly, increased sales are suggested by the pleasing effect on those millions of people who have not yet had their first ride. They are the future customers to whom airlines must appeal, as shown by the accompanying graph. This chart is taken from data compiled by the du Pont Company in an exhaustive analysis recently made of the air transport industry. Through 1933, the figures of the reports of the Bureau of Air Commerce on numbers of passengers are used. The figure for 1934 is the number of passengers that should have been carried if all airlines were to operate at their 1933 per cent of passenger capacity, which was approximately 44%. The data for 1935, 1936, and 1937 indicate the number of tickets that must be sold if all the airlines are to operate at 60% of passenger capacity, based on estimates of the equipment that should be available in each of those years. The figures are given below:

Year	Passengers
1929	173,405
1930	417,505
1931	522,345
1932	540,681
1933	568,940
1934	600,000
1935	1,200,000
1936	1,400,000
1937	1,600,000

Although air transportation has already made great advances, it still has a tremendous job to do.

There are definite advantages in using visible contrasting colors on aircraft, for our city airports are becoming more and more crowded. With smoke, haze, fog, rain, or snow in the air, the danger of air or ground collision increases yearly. Airport signal lights have been developed to minimize this hazard, but still the keen eyes of the pilots are the determining factors. Lemon yellow reflects light better than other colors. This fact is known to many pilots who have discerned Army planes or E.A.L. Condors on Newark Airport, while other aircraft are often not visible until the landing is nearly completed.

The effect of color on the public can not be ignored. Those millions of nonflyers can be moved to action by proper color in advertising, on time tables, or dress of personnel, and, foremost, on the planes themselves, especially when colored pictures of those planes are used for publicity. Although passenger air transportation is increasing rapidly with the advent of fast planes, a portion of that increase is due to those people who have flown before and are now flying more often. We expect them to continue to fly without the added appeal given by color, but air transportation figures must multiply themselves several times to meet the smallest hopes of those in the industry.

Many passengers comment on the attractive appearance of the new Curtiss-Wright Condor sleeper planes flown by American Airlines

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* *Alclad has a pure aluminum surface which is highly corrosion-resistant.*

** *Duralumin, (dural) after treating in an anodizing bath to increase its resistance to corrosion, is gray in appearance.*

The Kruesi Radio Compass for Commercial Use

FREDERICK W. LUTZ
Vice-President, Fairchild Aerial Camera Corporation

● The Kruesi Radio Compass, a new aid to aerial navigation under unfavorable weather conditions, has just been made available for commercial and private aviation by the Fairchild Aerial Camera Corp., manufacturer of the instrument under arrangement with Geoffrey Kruesi. This device is a simple, compact instrument which can be installed in any airplane and which may be operated in conjunction with commercial radio broadcasting stations as well as with the Department of Commerce airways and private airport stations. It serves as a homing device and, when the rotatable loop is employed, as a position finder.

The latest model, specially designed for commercial and private use, is a refinement of previous types developed at Wright Field, Dayton, Ohio, by Mr. Kruesi under the direction of Capt. Albert Hegenberger, of the U.S. Army Air Corps' instrument section. The Army type, a large number of which are being manufactured for the Army by Fairchild, has been tested under every service condition. It is the key unit in the Air Corps' blind landing system, and has already assisted in the completion of more than 2,000 blind landings. So successful has the Air Corps blind landing system been, that it was recently adopted by the Bureau of Air Commerce and recommended for use by the air transport lines. Regardless of the system or systems of blind flying and landing that may later be developed, the Kruesi radio compass will be an integral part of it.

The compass is simple to operate and requires no special training for successful use. Because it can be used independently of the Federal Airways System, it is claimed to be efficient wherever the pilot may be flying, as long as there is a broadcasting station within the set's range. Satisfactory bearings under average conditions may be received at a distance of 300 miles over land and 700 miles over water at frequencies under 600 kc. Under favorable conditions, bearing indications have been obtained from a distance of 1,500 miles, a particularly advantageous feature to the general commercial flying service operator and the private pilot whose trips take him away from the established airways. It also allows pilots flying the federal airways to deviate from the course to avoid unfavorable conditions without the risk of being unable to get back on the radio range beam later.

Whether the pilot is on or off his course is indicated by the position of the pointer on the large-faced dial. The pilot merely has to keep the pointer on zero to maintain his course, thus simplifying navigation and removing the necessity of continuous listening to beam signals by earphones. Furthermore, the radio compass has a longer range than the radio range beacon, an especially important factor in flying in territory not served by government stations and it can be used on the ground for determination of position in forced landings in remote areas.

The instrument consists of a single compass receiver unit, mounted in an out-of-the-way place on the ship; a remote control box for tuning, for automatic or manual volume control and switching, mounted within convenient reach of the pilot (not necessarily on the instrument board); a dynamometer-type bearing indicator which is mounted on the instrument board; and a fixed loop for homing purposes only, or a rotatable loop for both homing and position finding, mounted on the airplane. A dynamotor and the airplane storage battery supply the necessary current.

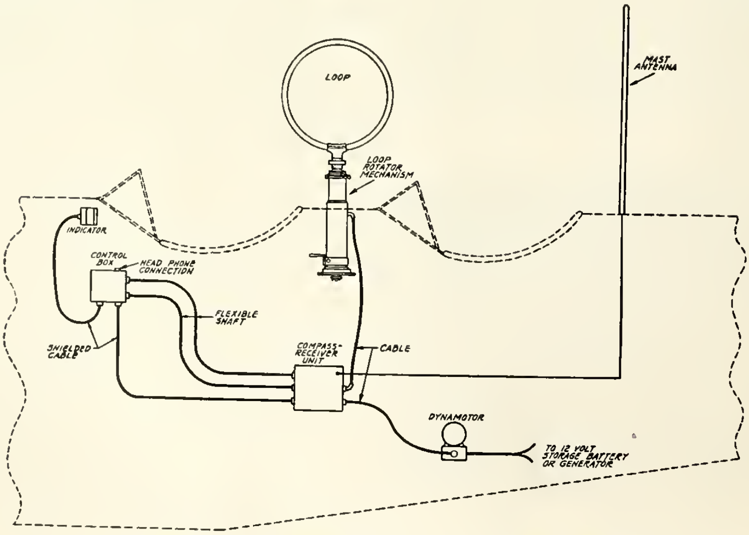


Diagram showing installation of the Kruesi radio compass

The compass receiver unit has a frequency range of 150 to 1500 kc. in four bands: 150-300, 250-500, 450-900, and 800-1500 kc., the change from one band to another being accomplished by remote control switching. The compass receiver unit embodies a superheterodyne receiver with five tubes; three other tubes are included in the radio compass circuit. In the sets designed for commercial and private use, the receiving apparatus has been built into a single unit requiring less than 1,000 cu. in.

The remote control box, which occupies about 100 cu. in., includes the tuning dial, calibrated for the band (or bands), which are used by the operator, a convenient handle for turning the tuning dial, a pair of switches and a jack for the headphone set.

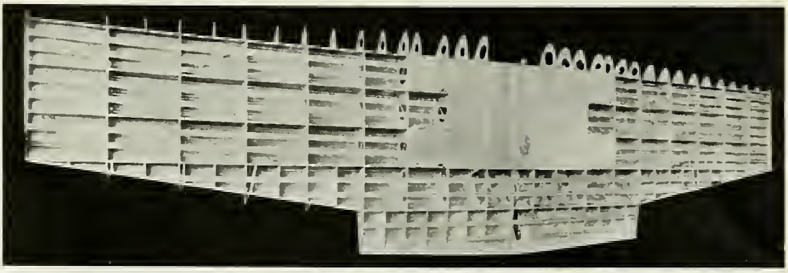
The iron core dynamometer-type bearing indicator, mounted on the instrument board, has a black face with pointer and scale in luminous radium material. The pointer has movement of 70° and a sensitivity of 100 microamperes at full scale. It is designed to move smoothly regardless of the attitude of the airplane, and static has little effect upon the pointer inclinations. To a certain degree the pointer may be used as a turn indicator.

The streamlined demountable loop, 21 in. in diameter, has a drag of approximately 4 lbs. at a speed of 190 m.p.h., and 8 lbs. at 250 m.p.h. when at right angles to the direction of flight. The rotatable loop can be moved by hand 360° and may be locked in any position. A standard mast antenna, projecting 6 to 8 ft. from the fuselage, or a fixed wire antenna between 9 and 10 ft. in length, are used in conjunction with the loop. The receiver unit, bearing indicator, loop and rotating mechanism weigh approximately 45 lbs.

To use the radio compass, the pilot selects the station (government or commercial) toward which he wishes to fly, switches on his headphones, and sets the

(*Continued on page* 75)

Seversky Basic Trainer for the Army Air Corps



Wing construction showing tank installation

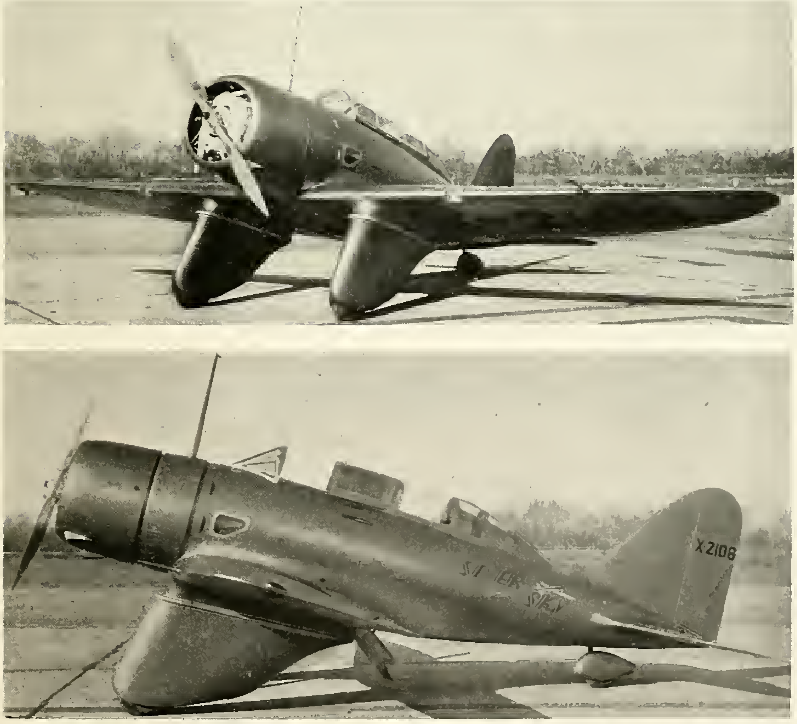
● The new SEV-3XAR basic training plane for the U. S. Army Air Corps is a low-wing, all-metal monoplane manufactured by the Seversky Aircraft Corp., Farmingdale, Long Island, N. Y.

Featuring a number of departures in construction and design, this plane is quickly convertible into a seaplane or amphibion, and also provides performances never before attained in service training craft.

Fuselage construction follows semi-monocoque design throughout, with the front main bulkhead connected to the corresponding webs or spars of each box section of the wing. Fuselage bulkheads are connected by stringers in the form of extruded channel sections and each junction of bulkhead and a stringer is pin-jointed, stresses being carried by the smooth skin covering.

Multi-spar construction, insuring sheet-metal stiffness, is utilized for the wing, upon which the fuselage rests. The smooth outer skin is reinforced with corrugated sheets on the inside with the corrugations running along the span. The bottom skin is stiffened by using a channel section which forms a closed box section extending the length of the skin. This construction provides wing-ruggedness and while the weight per square foot of wing area is less than 2 lbs. the structure shows high torsional rigidity and has a designed load factor of more than 10. Five points of attachment, on each side, are used at the juncture of the wing and fuselage, precluding the necessity of reinforcement for concentrated loads, stresses in this case being distributed along the skin.

The fuel tank is built into the wing by riveting the center portion of the wing so that an air-tight compartment is formed, and sealing is accomplished by a process developed by the manufacturer. This process is also being utilized in connection with the entire wing which will make it buoyant in the event of landings on water.



Three-quarter front and direct side views of the SEV-3XAR Army training plane

Tail surfaces have been designed to insure rigidity and to minimize vibration. The fin and stabilizer are built integrally with the fuselage and longitudinal aerodynamic balance is achieved by the use of tabs. Controls are equipped with ball bearings.

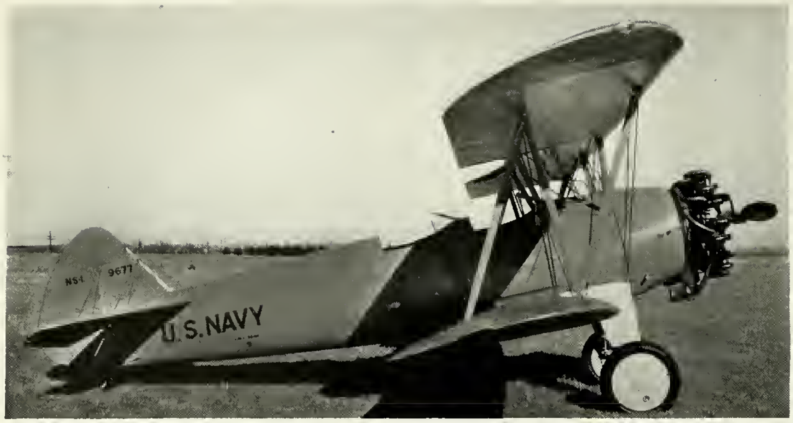
The fixed landing gear is of skin-stressed cantilever type with streamlined tires and wheels and hydraulic air and oil combination shock absorbers. A complete retractable gear mechanism is provided together with the necessary handles and warning signals, enabling the student pilot to go through the motions of handling a plane with retractable landing gear.

Another feature of the SEV-3XAR is the crash-proof headrest located between the two pilots and so shaped that it does not distract from the vision of the instructor. This is achieved by constructing the headrest so that it follows the contour of the silhouette of the front pilot. In addition to serving as a headrest, this member contains a loop antenna for the direction finding radio compass, the latter also permitting reception when the hood of the plane is completely enclosed.

Converting the landplane into a seaplane or amphibion may be accomplished in an hour, by substituting the twin-float amphibion landing gear for the fixed landing gear. Training can then be given on both land and water.

The engine mount is of welded chrome-molybdenum steel tubing with rubber vibration absorbers utilized at the point of attachment to the engine. Fittings are so designed that any one of four engines, the Wright Whirlwind R-975E or E3 which deliver 350 and 440 h.p., respectively, the R-985 P. & W. Wasp, Jr., or the R-1340 Wasp can be installed. The cowling is of the double venturi type, providing adequate housing with minimum drag.

The plane's top speed with either the Wright Whirlwind or Wasp engine, at sea level is 200 m.p.h., with a stalling speed of 60.5 m.p.h. at sea level. It can climb to 12,000 ft. in ten minutes and has a service ceiling of 21,500 ft. Its cruising speed is 187 m.p.h., its range at full throttle 633 miles, and its range at cruising speed 742 miles.



Stearman Model 73 Trainer

● Forty-one two-place primary training planes for the U. S. Navy are now under construction at the Stearman Aircraft Co., plant in Wichita, Kan., in line with a contract recently awarded.

Designated as Model 73, the plane is equipped with a 220 horsepower Wright engine, has a high speed of 125 miles per hour and climbs to a service ceiling of 14,000 feet. Features include the plane's ability to take off and clear a fifty-foot obstacle within 750 feet in still air with full load and to land over the same obstacle within the same distance; maximum visibility, maneuverability and controllability, and easy accessibility of parts for inspection, maintenance and repair.

Wings consist of laminated spruce spars, spruce ribs and aluminum alloy channel drag struts, all fabric covered. Interplane and cabane struts are of streamline steel tubing and ailerons are of riveted aluminum alloy construction, fabric covered.

The tail group is of welded steel tube construction; the stabilizer is fixed, horizontal trimming being effected by an elevator tab.

Welded steel tube frame, fabric covered, is utilized for construction in the fuselage. The full cantilever type landing gear and the tail are oleo equipped. Back of the rear cockpit is a compartment for cockpit covers, luggage and necessary equipment.

Performance of the Model 73 is as follows:

Maximum speed at sea level	125 m.p.h.
Stalling speed at sea level	51 m.p.h.
Climb to 5,000 feet	8.8 minutes
Service ceiling	14,000 feet
Endurance at top speed	2 hours
Endurance at 60% h.p.	6.5 hours
Range at top speed	250 miles
Range at 75% h.p.	430 miles

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Wood and Metal Construction

From Wood to Metal (Dal legno al metallo), R. Verduzio. L'Aerotecnica, Vol. 14, No. 10, October, 1934, pp. 1128-1137.

ADVANTAGES AND inconveniences of using wood construction for airplanes are pointed out and problems arising from the use of the exceedingly thin sections required in metal structures for airplanes are discussed. The author describes the secondary stresses which must be considered in thin metal construction and the static and dynamic stresses involved. He gives a number of suggestions for the use of metallic materials in aircraft.

Airplane Windscreens

Windscreens with Openings, F. B. Bradfield and B. Lockspeiser. (British) Aeronautical Research Committee—Reports and Memoranda No. 1613, December 6, 1933 (published December 13, 1934), 7 pp., 7 figs.

RESULTS OF wind-tunnel and full-scale investigations of two types of windscreens with openings, namely the deflector and divided types, are discussed. The deflector type provided the pilot with a shielded area about 6 in. wide, enabling him to look around the side of the screen without discomfort. Flight tests with the divided windscreen, which the authors consider shows great promise, were conducted in adverse as well as fine weather, and in all cases a good view forward was maintained.

French Airplanes

Sixth Review of French Aeronautical Equipment Exhibited at the Fourteenth Paris Aircraft Exhibit (VI^e Tableau l'Aéronautique Français—14^e Salon de Paris), P. Leglise, J. Gaudefroy. L'Aéronautique Vol. 16, No. 187, December, 1934, pp. 287-334, many figures.

A TABLE giving the chief characteristics of 46 types of French airplanes, produced between December, 1933 and December, 1934, precedes the 31 detailed descriptions of these airplanes which were displayed at the Fourteenth Annual Paris Aircraft Exhibit. The drawings and photographs included with the descriptions illustrate the construction of the parts of particular interest.

The majority of the planes described are bombers and fighters, although a few transport and sport planes are also covered.

Wing Structures

Wing Structure with Two Spars with Ribs (Strutture alari a due longaroni con centine), C. Minelli. L'Aerotecnica, Vol. 14, No. 5, May, 1934, pp. 493-531, 12 figs.

A CANTILEVER wing having two spars with ribs and variable rigidity is examined on the hypothesis that the bending stiffness of the spars, and the torsional stiffness of both spars and ribs are varying along the wing according to exponential laws. The author integrates equations for the torsion angle and, by extending the theory of Gabrielli, solves the problems of elastic equilibrium and relative stability (critical stability). He then considers a continuous wing having two spars with several supports provided by a couple of struts, each of which can carry a small elastic rotation, and establishes an equation of continuity, analogous to the three-moment equation, between the moments in the spars under three successive supports. He derives a system of equations by which it is possible to determine the elastic equilibrium of a structure and the equation of critical velocity.

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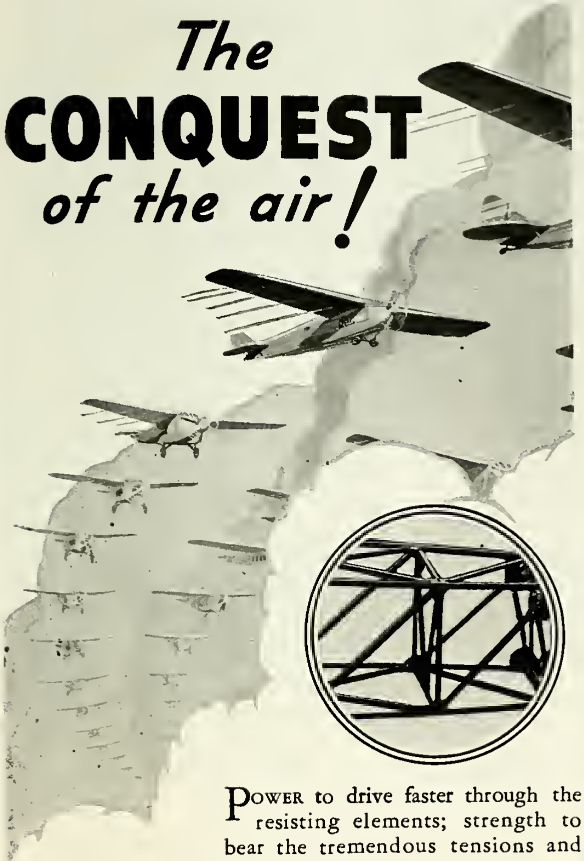
The CONQUEST of the air!



Power to drive faster through the resisting elements; strength to bear the tremendous tensions and strains that great speed imposes, lightness to ride easily on the wind—a union of all of these with nicety of balance nowhere else required, has been involved in man's conquest of the air.

An important contribution to this success was the tubular steel frame, incredibly strong and as free from excess weight as the bony structure of a gull. In the development of suitable material, National-Shelby Seamless Aircraft Tubing has kept pace with the most advanced engineering, from the earliest days of the industry until now. The uniformity of every piece is as near to the absolute as science and organization can go. Ask for literature on National-Shelby—

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Choice of Engines

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Without Motor and Propeller

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BRADFORD, PENNSYLVANIA

(*Continued from preceding page*)

Wing Flaps

Wing Flaps and Other Devices as Aids to Landing, R. P. Alston. Royal Aeronautical Society—Preprint for meeting December 6, 1934, 13 *pp.,* 6 *figs.*

PRINCIPLES OF operation governing various high-lift devices for airplane wings are reviewed and available wind-tunnel data examined. The author points out that experiments on the effect of variation of flap span should have been associated with measurements of tail flow since there is a certain amount of full-scale evidence that in order to maintain sufficient downwash at the tail on low-wing monoplanes it is essential to run the flap across the center of the wing span. He shows what can be done with partial-span flaps and describes special ailerons for use with full-span flaps. He takes up pitching moments due to split flaps and discusses operating forces for these flaps, the slotted flap, and air-brake devices.

Wing Flaps

Experiments on a Wing with Auxiliary Rear Flaps (Esperienze su un'ala munito di aletta ausiliaria posteriore), A. Eula L'-Aerotecnica, Vol. 14, *No.* 10, *October,* 1934, *pp.* 1111-1127, 11 *figs.*

A SERIES of experiments on a wing model with an adjustable rear flap are described. The chord of the flap was almost one-eighth of the wing chord, both wing and flap having a complete profile, that of the latter being symmetrical. The greatest increase of the maximum lift coefficient was about 23%. The maximum efficiency of the wing with the flap was lower than that of the wing alone, but for small wing incidences and small flap angles, the drag was also lower, diminishing in the most favorable position to 20% with a remarkable increase of efficiency. The wing with the rear flap was found to be equivalent to the slotted wing. The author concludes that if the rear flap is adjusted correctly to the variations of wing incidence, an increase in speed range may be attained.

L'Aéronautique for November, 1934 (L'Aérotechnique supplement, pp. 101-103, 7 figs.) describes arrangements of flaps employed on the airplanes participating in the Challenge de Tourisme.

Instrument Dials

The Utilization of Phosphorescent Substances in Aeronautics. Apparatus for Measuring Very Low Illumination (L'Utilisation des substances phosphorescentes en aéronautique. Un appareil de mesure des très faibles brillances), M. Roulleau and de M. Lebelle. Publications Scientifiques et Techniques du Ministère de l'Air, No. 48, 1934, 49 *pp.,* 18 *figs.*

RESULTS OF systematic tests on phosphorescent substances, which have been carried on for several years in the optical laboratory of the Service des Recherches, are discussed and their practical application in the production of luminous dials for aircraft instruments is shown. The authors take up the properties and methods of preparing such substances as the barium, calcium, strontium and zinc sulphides and describe apparatus designed by Labussiere, Chief Engineer of Aeronautics, for studying the vision of low illuminations and glare. They also give the design of a simplified apparatus for examining luminous products.

Fuel Injection

On the Effect of Pipe Bores on the Cut-Off of Fuel Spray in Injection Systems with Open Nozzles, F. Nakanishi, M. Ito and K. Kitamura. Tokio Imperial University, Aeronautical Research Institute—Report No. 108, *Vol.* 8, *No.* 12, *June,* 1934, *pp.* 417-435, 12 *figs. In English with Japanese abstract.*

RESULTS OF experiments are described which were made to ascertain the effect of pipe bores in compression-ignition engines on the pressure variation at the nozzle after the cut-off of oil pressure at the fuel pump. Oil pressure was recorded by a modified high-speed optical indicator invented by the authors. It was found that for sharp cut-off there is a lower limit to the oil speed in the injection pipe. When the oil speed is below this limit, the pressure cannot be cut off sharply and the pressure-time curve takes the form of steps. If the oil speed is higher than an upper limit which was found also, or the pipe very small compared with the nozzle, the experiments indicated a pressure-time curve likewise in the form of steps.

Aileron Stability

Aileron Stability, with Special Reference to Rolling-Aileron Motion and the Influence of Frise-Type Hinge-Moment Curves, A. G. Pugsley. (British) Aeronautical Research Committee—Reports and Memoranda No. 1595, *February,* 1934 *(published November* 15, 1934), 29 *pp.,* 10 *figs. on supplementary sheets,* 6 *tables.*

THE THEORETICAL investigation described deals with the possibility that at high speeds there occur aileron instabilities which are not necessarily associated with wing elasticity. The author concludes that rolling-aileron oscillations can arise, independent of wing elasticity, particularly with ailerons having Frise-type non-linear hinge-moment curves, and that in practice a linear theory restricted to rolling-aileron motion will normally be sufficient for considering the onset of aileron instability. A procdure is given for estimating the critical instability speed introduced by control elasticity in the case of ailerons with Frise-type hinge-moment curves and for such ailerons certain practical preventive measures are put forward.

Detonation

Causes of Detonation in Petrol and Diesel Engines, G. D. Boerlage and W. J. D. Van Dyck. Royal Aeronautical Society Journal, Vol. 38, *No.* 288, *December,* 1934, *pp.* 953-974 *and (discussion) pp.* 974-986, 22 *figs.*

THE PHENOMENA of combustion in Diesel and gasoline engines are treated from the same aspect, the authors pointing out that in both cases the number of collisions of activated reagents is decisive and that self-ignition may be influenced equally by activated oxygen as by activated hydro-carbon. They differentiate between "detonation" or "pink," "knock," and "bumpy running."

They conclude that, to avoid knock in the Diesel, compression must be taken far beyond the point corresponding to the temperature of auto-ignition in order to have admissible short delays, while in the gasoline engine, compression must only be taken to a temperature far below that of auto-ignition, as an excessive flame compression ratio must be avoided. They discuss causes of extremely rapid pressure rises and take up the physical factors accelerating combustion, including mixture, temperature, pressure, spark setting and injection timing, swirl and turbulence, and vibration, as well as the chemical accelerating factors. The authors' apparatus for measuring the initial cracking speed of a fuel is described and the results of their tests outlined.

Airplane Landing

The Landing of Aeroplanes. Part I, Note on Modern Landing Technique, R. P. Alston. Part II, Chart Showing the Effect on the Landing Runs of Drag-Lift Ratio and Touching Speed. Study of the Effectiveness of High Lift and Air Brake Devices in Reducing Landing Runs. L. W. Bryant. (British) Aeronautical Research Committee—Reports and Memoranda No. 1598, *November,* 1932 *(published December* 20, 1934), 16 *pp.,* 18 *figs.*

IN THE investigation described, the four-stage landing theory of Part I is developed in Part II to form a basis for comparing the characteristics of various airplanes. The author concludes that ground angle in excess of stalling angle is the main cause of a heavy drop on landing, that the tendency to float is mainly the effect of increased aerodynamic efficiency and is independent of ground incidence, and that some form of airbrake is necessary. He considers that the Schrenk plate, fitted normal to the under surface of the wing and at about one-tenth of the chord from the trailing edge, fulfills the necessary conditions; that the Zap flap may go a step further; and that a spoiler employed as a small projecting plate normal to the upper surface towards the leading edge, and reinforced by powerful wheel brakes, is about equivalent in its effect on the total landing space to the Schrenk plate without the help of wheel brakes.

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AIRCRAFT MAGNETOS

NEW EQUIPMENT and METHODS

Flashing Neon Signs For Sky Messages

• RELAYING ADVERTISING and other messages to people on the ground by flashing neon signs on airships has been accomplished through extensive experimental and development work over a period of years.

In the early days, sky advertising indicated possibilities, but limitations of the equipment used to flash the message, made it a somewhat restricted field. However, research has developed this utility to the point where a complete message can be flashed without changing the sign from one message to another, and several national advertisers, including the Frankfort Distilleries, are augmenting their regular advertising campaigns by using these sky signs.

The complete installation weighs approximately 490 pounds, and the letters are flashed on a universal-type composite sign frame, ten such frames being accommodated on the side of the ship to enable showing any 10-letter word. To avoid breakage of tubing while frames are being removed, it was decided to employ clip-type ferrules.

Very small, short, light-weight electrodes are used in the tubing to allow illumination as close to the end of the tube as possible, eliminating any dark spots on the letters, and allowing complete filling-in, so that a sharp, unbroken letter is visible.

Control of the various segments of the ten composite frames is accomplished by using 350 midget-type relays especially built of light-weight material. Leading from each frame to the control car of the ship is a 38-wire control cable which is attached to the ship by harness-snap fasteners, while the frame is attached to the side of the ship's gas envelope by straps fastening to patches.

A one-inch perforated paper-tape which runs through a 38-pound mechanical translator device controls operation of the sign. The translator distributes impulses to the proper relays on the sign frames, which in turn cause illumination of various letters.

The tape is perforated on a small, hand-operated block-punch and only a few minutes are required to perforate a tape which will flash a complete message on the airship's side. Previous to flight, the tapes are perforated and the pilot can change the message at will by replacing tapes in the flashing device.

Power is supplied by a light-weight 110 volt, 60 cycle, AC 1250-watt generator mounted on one of the ship's engine outriggers and cooled by the slipstream of the propeller.

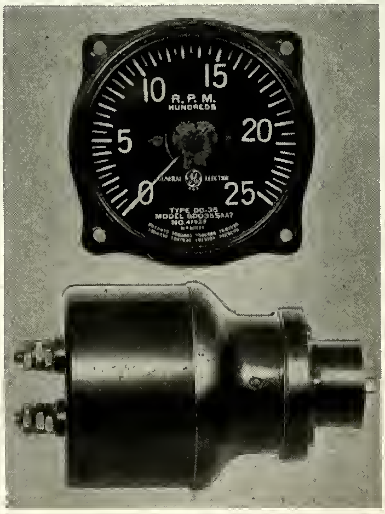
A special 7-pound, aluminum-encased transformer, rated 18 mm. and having a secondary voltage of 8500, is installed on each frame.

Members of the Goodyear Tire and Rubber company's airship operations department have been instrumental in evolving many of the refinements of the neon-flashing sign and H. W. Crum, who is in charge of experimental work and airship sign development, holds patents on the sign equipment.

G-E Aircraft Tachometer

• A THREE-POUND tachometer, designed and constructed to withstand operating conditions of aircraft service and also applicable to any equipment which can be provided with a standard S.A.E. aircraft-engine outlet, has been introduced by the General Electric Co., Schenectady, N. Y. Features include ease of reading and long life.

The instrument operates on a generated-frequency principle, so that neither loss of voltage in the generating unit nor polarity of the leads affects the accuracy of the reading. Its generating unit has no brushes or slip-rings and the generating-unit-rotor is direct-driven; hence, no gearing is required and maintenance is minimized. The indicating instrument is calibrated for temperature effects and has a pointer that remains steady under all conditions.



Dial face and generating unit of the General Electric Tachometer

The standard tachometer is designed so that the indicator reads from 0 to 2500 r.p.m., when the generating unit is turning from 0 to 1250 r.p.m., but a wide range of optional driven and indicated speeds may also be obtained.

Unbreakable Piston Ring

• A NEW-TYPE piston ring of low-friction, unbreakable material has been produced by the Simplex Piston Ring Co. of America, Inc., Cleveland, Ohio. Extensive tests in the factory and by distributors, it is claimed, show the Simplex Molium ring not only reduces cylinder wall wear but also friction losses within the motor, thus lowering motor temperatures and resulting in a freer running engine. Compression is restored and oil pumping stopped, even where cylinders are worn, due to the expander inner ring principle and the multiple edge laminated design.

The results obtained with the new rings are due to three departures from conventional design. These consist of the Simplex full width, inner ring principle, shaping the ring to fit and seal the cylinder; laminated construction of flat, spiral-shaped sections, providing groove and gap seal in addition; and the use of Molium, a new metal developed by the Simplex company.

Molium possesses many properties of bronze bearing metals. It cannot scratch or affect the cast iron of the cylinder wall, and in tests over extended periods, has produced virtually no measurable wear. At the same time, the ring provides long life due to the self-lubricating qualities both of the metal, and of the ring design.

The ring is simple to install, as its sections are identical, with no "top" or "bottom," cannot break, and requires no gap filing or fitting.

Air Filtered Portable Grinder

• CHICAGO WHEEL & Mfg., Co., Chicago, Ill., announced a new high-speed portable electric grinder of the universal type which incorporates a built-in filter.

The tool weighs 4 lbs., turns up 17,000 r.p.m., and can pull a wheel 2″ in diameter. Motor housing of heavy cast aluminum extends out over the motor shaft and air filter, and is encased with an insulating cushion grip, giving positive control and operating flexibility. It is compact, well balanced and, with suitable grinding wheel or cutter in the universal case-hardened chuck, will work at an angle and get into and around corners, irregular shaped holes and other hard-to-reach places.

The filter is of the viscous type, easily removable for cleaning and re-oiling and advantageous in increasing the life of all moving parts.

Spitz Flight Recorder

• FURTHER PROGRESS in combating the weather handicap in scheduled air transport operations may come from the Spitz Flight Recorder developed by Dr. Samuel Spitz, Los Angeles inventor of the Marimeter, the depth sounding device used by the U. S. Navy.

The flight recorder is a radio device with a two-fold purpose; it not only shows where the plane is at all times in flight but it also shows where it lands.

By means of a small light actuated by short wave radio impulses, a light moves across a strip map of the plane's route accurately tracing its movements. The sound of the plane's propeller is picked up by two small microphones installed on the plane. Then, it is relayed through the plane's radio transmitter back to the terminal or base of operations where it is picked up by an automatic tuning device and then to two new instruments, the binaural indicator and the divergence wave indicator. The former gives the direction in which the plane is traveling and the other gives the airplane's distance from its base of operations.

The flight recorder has been designed to protect and aid the pilot in all forms of aerial transportation, and principally for blind flying. With its aid the dispatcher knows the location of the airplane at all times. In the event of deviation from the designated course, he can immediately notify the pilot by the short wave radio and direct him back to his course as well as give him the necessary information pertaining to the terrain over which he is flying. In the event of a forced landing, the light continues to burn on the map at the point of landing and the operator at the terminal can immediately dispatch aid. A landing map is also a part of the recorder. It has been designed to land the airplane at either end of the terminal. For instance, an airplane leaving the airport at Los Angeles can be landed in San Francisco by the operator at the Los Angeles terminal, or vice versa.

If there is more than one airplane in the air, each operating company will control the operations of their aircraft. The installation of the variable condensers in the automatic tuning device will depend on the number of airplanes to be operated by each respective company.

Developing Aerial Films

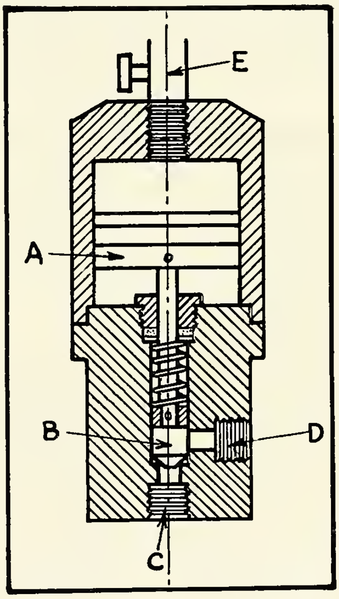
• A METHOD which enables aerial photographers to put exposed films in process before returning to their bases and while yet in the air, has been developed by Davidge Film Laboratory, Hollywood, Calif.

Tanks are completely molded in Bakelite material and light is kept out of the roto-tanks by a by-pass which also drains the tank of its developing solution. Other construction features produce maximum agitation, insuring rapid uniform development of both high-lights and shadows with color separations and gradations. Film capacity is 25 ft. of 35 mm. film, or 50 ft. of 16 mm. film. The amount of developing solution required is about 18 fluid ounces.

Automatic Safety Valve

• THE VACOMATIC Safety Valve, an automatic fuel shut-off device, has been developed by the Vacuumatic Valve Co., New York, N. Y., to eliminate the use of all manually operated fuel line valves now in aircraft use.

This safety valve, which closes all fuel lines the instant the ignition switch is "cut," is small and simple in operation. The valve is operated by utilizing the drop in pressure in the intake manifold. Referring to the sketch, the operation is as follows: Valve *B* remains closed under the action of a spring and prevents the flow of fuel through *C*, the fuel intake and *D*, the fuel outlet. An electrically-operated three-way valve is placed in the intake pressure lead and wired into the ignition circuit. When the ignition switch is closed, the manifold-pressure valve *E* closes the passage from the intake manifold to the low pressure chamber and opens the low pressure chamber to the atmosphere. The increase in pressure in the chamber permits the spring to seal the valve *B*, closing the fuel passage *C-D*.



Sketch of Vacomatic Safety Valve

Battery Charging Equipment

• A RUBBER-PROTECTED Tungar battery-charging cabinet, which combines charger-tester and cabinet facilities in one compact, neat unit, was exhibited for the first time by the General Electric Co., at the New York Automobile Show, last month.

The new cabinet is designed for use with Tungar battery service units of the one-panel type which combine a charger and a four-meter tester both mounted neatly on top of the cabinet. The cabinet, standing about 64″ high, is of six-battery capacity; it has four molded corrosion-resistant hard-rubber doors with a contrasting stippled finish. The four-door design minimizes the space requirements of the cabinet when its doors are opened. A rubber drawer, located in the center of the four-door front, provides space for battery tools and also, when open, acts as a platform on which batteries may be conveniently tested while the doors are closed. Adequate ventilation is provided to permit escape of acid fumes. The cabinet is available with eight different charger-and-tester combinations which may be of either the 24- or the 12-hour-charging type.

Carbide Grinder and Finisher

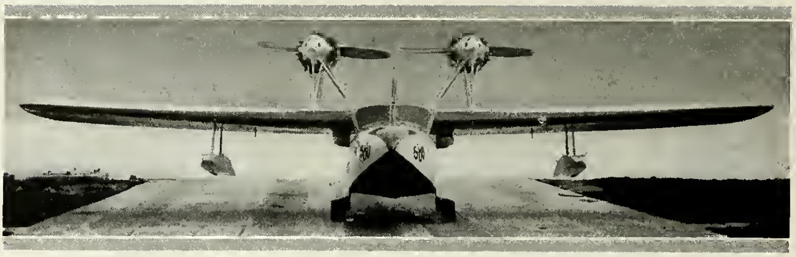
• A CEMENTED carbide grinding and finishing machine, just announced by Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich., offers a modern method of sharpening tungsten and tantalum carbide tools. It will increase the life of tipped tools and reduce the time required for sharpening them.

The machine is compact and sturdy, reducing vibration to a minimum. An inbuilt balanced ¾ h.p. electric motor, which drives two diamond-impregnated wheels, is mounted at the top. The diamonds are impregnated to a depth of ⅛″ on the face of the wheel, which is available in the coarse, fine and extra fine grades.

Precision - developed Ex - Cell - O ball bearings are mounted at each end of the motor, and support the diamond wheels on a common shaft, eliminating wheel end-play. Coolant is supplied to each wheel to keep them clean and to control the generated heat at the point of contact between the wheel and tool being sharpened. At present, plain water only can be used as a coolant due to the nature of the bonding of the wheels; it can be supplied to the wheels by an electrical motor-driven water pump and tank, or directly from the city water pipe lines.

A reversible switch on the motor located at the rear of the machine provides the correct rotation of the wheels for both right and left-hand tools.

Savoia Marchetti S-80 Amphibion



● Intended primarily for sport and pleasure flying a new twin-engined, low-horsepowered amphibion, the Savoia Marchetti S-80, has been developed by Societa Idrovolanti Alta Italia in Milan, Italy.

Seats have been provided for four persons, the front two being adjustable. Dual controls are installed. The retractable gear is of a new and patented type, folding into wing wells at the intersection of the wing and fuselage, with the mudguard forming a streamlined effect as it fits into its retracted position. Dunlop balloon tires ease landing shocks when the ship is brought down on land.

Following Savoia Marchetti practice, the hull is constructed of wood, fabric covered and treated for watertightness. The planing bottom, of the double-tab type, is of plywood and cedar, riveted with washer-equipped cooper rivets and supplied with an intermediate layer of fabric and waterproofed compound.

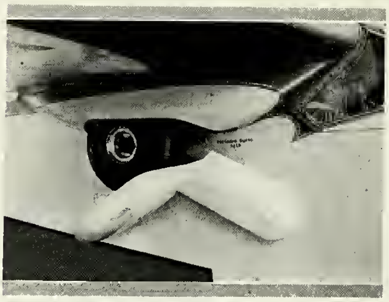
The full cantilever wing is fabric-covered plywood with watertight sections which are sufficiently buoyant to float the plane for an indefinite period. Wing flaps constructed of steel tubes aid in decreasing the landing speed.

The stabilizer is of wood construction while the elevators and rudder are of welded steel tubes, all fabric covered. The stabilizer is adjustable in flight.

The two 75 h.p. Pobjoy engines are mounted in pusher fashion on chrome molybdenum frames on top of the wing, one on either side of the cabin, with the engine nacelles housing an oil tank for each unit.

Specifications and performances are as follows:

Wing span	36 feet
Overall length	25 feet 5 inches
Overall height	9 feet 1 inch
Empty weight	1719 pounds
Useful load	880 pounds
Gross weight	2599 pounds
Top speed	123 miles per hour
Cruising speed	109 miles per hour
Landing speed (flaps)	47 miles per hour
Climb to 3280 ft. (1000 m.)	4.5 minutes
Climb to 6560 ft. (2000 m.)	10.7 minutes
Climb to 13,124 ft. (4000 m.)	32.1 minutes



S-80 landing gear fairing

Junkers Ju 160

● The high-speed Ju 160, a development of the experimental Ju 60, embodying new principles of design and available both for passenger and freight transport, is an 8-place, single-engined, low-wing cantilever monoplane equipped with a retractable landing gear.

Built principally of duralumin, high tensile steel has been used at important joints, with the skin of corrosion-proof dural sheet. Deviating from previous Junkers practice, the customary corrugated sheet usually found in aircraft manufactured by this company has been replaced by smooth sheet with sunken riveting to reduce resistance.

The fuselage is built up of 4 longerons with vertically disposed cross-members, the forward section being rounded and conforming to the diameter of the cowling. The cockpit roof fairs into an oval section, tapering aft into a cut-out into which the fin and rudder are inserted.

The wing-unit is of marked arrowhead and Vee construction, the 10 ft. 4 in. center-section being connected to and projecting from the fuselage into which it is faired, the 2 main spars being connected by sturdy cross-members and reinforcing ribs. Ball joints are employed to connect the outer sections to the center section and the Junkers auxiliary wing with anti-bump device is installed to reduce landing speeds. The wings house the two main fuel tanks with a total of 127 gallons.

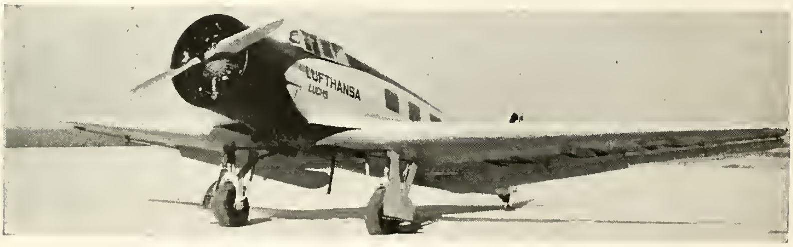
Controls follow standard Junkers design, with the fin and rudder carried from the vertical cut-out, the adjustable tailplane being journalled on the upper surface of the fuselage. Control surfaces are balanced, the elevators and ailerons being mass-balanced in addition. Tailplane adjustment and auxiliary wing-flap operation are inter-coupled, but each may be operated independently.

The landing gear is of the individual divided type, attached to the wing center-section. In flight it retracts between the center-section main spars, drawing up streamlined coverings that fair into the main structure. Wheels are mounted on Elektron cast forks from Faudi sprung legs and are equipped with oil-pressure brakes.

Power is supplied by a 700 h.p. Hornet engine built by Bayerische Motoren Werke, A.G. in Germany under license of the Pratt & Whitney Aircraft Co., and equipped with a Hamilton Standard controllable-pitch propeller and an NACA cowling. The engine mount is detachable by means of 4 ball joints while a 15-gallon oil tank is housed in the engine bay.

Specifications and performance of the Ju 160 are as follows:

Length overall	38 feet 4 inches
Wing span	47 feet 3 inches
Empty weight	5290 pounds
Useful load	2535 pounds
Payload	1325 pounds
Gross weight	7825 pounds
Fuel capacity	127 gallons
Oil capacity	15 gallons
Maximum speed	211 miles an hour
Cruising speed	186 miles an hour



Flaps and retractable landing gear are Junkers Ju 160 features

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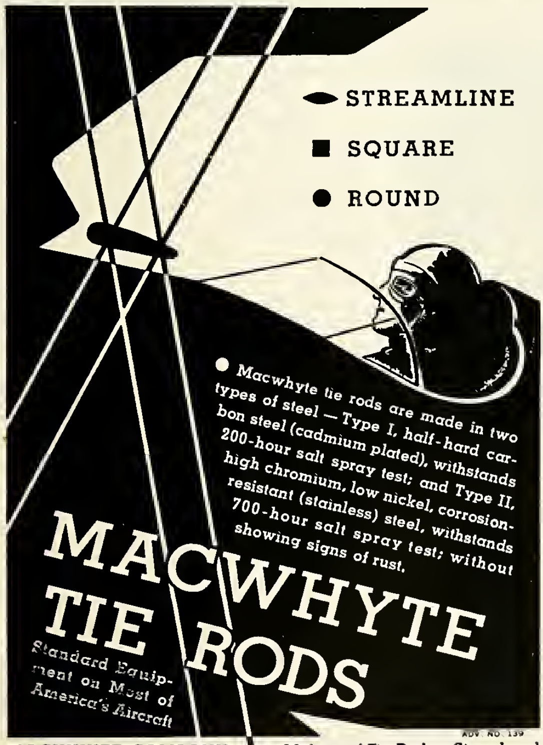

● Macwhyte tie rods are made in two types of steel — Type I, half-hard carbon steel (cadmium plated), withstands 200-hour salt spray test; and Type II, high chromium, low nickel, corrosion-resistant (stainless) steel, withstands 700-hour salt spray test; without showing signs of rust.

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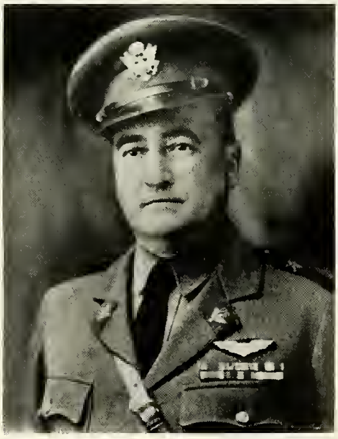
Cy Caldwell

● COLONEL CHARLES H. Danforth, Commanding Officer, Langley Field, Virginia, was born in Washington, D. C., Feb. 5, 1876. He doesn't look a day over 45, as this recent photograph bears witness, and in spirit he is a sprightly youth, sizzling with zest and vigor, as keenly interested in life today as he was when, a lad of 18, in Oct., 1894, he became a First Lieutenant in the District of Columbia National Guard. He undoubtedly is much jollier now than during the period between June, 1898, and June, 1899, when he was a private in the 4th United States Volunteers, served at Manzanello, Cuba, and rose through the ranks of Sergeant, First Sergeant, and Sergeant Major to the lordly position of Second Lieutenant. He must have been far too busy then to be jolly; so he makes up for it today, seated in the C.O.'s chair at Langley Field, discoursing on this and that for the enlightenment of inquiring and unenlightened visitors like myself—who spent a most delightful hour with him recently. If there's anything about the Air Corps he doesn't know, and about which he doesn't have sound opinions, I failed to detect it. He is further distinguished as one of the six original readers of this department, which stamps him as a man of learning and discrimination, with a fine taste for classical literature. (Advt.)

Colonel Danforth comes of a long line of distinguished people, which is especially interesting to me as I recently had my own family tree traced to where it was a mere shrub. The digger-upper of ancestors, by perusing old court records, traced my folks back to one "Horse-face" Caldwell, a Bluenose, killed in the war of 1812 when a puncheon of rum rolled over on him, and to a still older Cy Caldwell, nicknamed "Baa-baa" because, oddly enough, sheep used to follow him home—or so he claimed when he was tried and hung for sheep stealing. At that point I lost interest in my ancestry, and took up the study of Colonel Danforth's forebears, all of whom appear to have avoided arrest in some unexplained manner — I suppose they were smarter than the old Caldwells.

His father was Judge Charles Danforth, of Le Roy, N. Y., and his mother Dana Jones of Clear Drinking Manor, Montgomery County, Maryland. On his father's side he is descended from Nicholas Danforth, who landed at Salem, Mass., in 1636. Why Nicholas had to leave England was not disclosed. The female line comes from the Parker family of Norfolk, Virginia, which left Macclesfield, England, for religious reasons—so they said, but there were other rumors. This Parker family got mixed up with the Sinclair family of Isle of Wight County, Virginia—and the Sinclair family had got away from Cathness, Scotland. Just in time, so it was said by malicious persons. The way I feel about these old families that were prominent in the Army and Navy and the American Revolution is not so much an interest in the fact that they got here early as in the reasons why they felt the urge to leave a country where hanging was considered a natural death, and come to a wilderness where tomahawking and scalping were the conventional means of exit. One of Colonel Danforth's ancestors — probably the one he sets the most store by—was Colonel Robert Hanson Harrison, Secretary and Aide-de-Camp to General George Washington during the entire period of the American Revolution, which in retrospect seems pretty much wasted effort—the colonists objected to a tax on tea, and now look at the taxes on whiskey, gasoline, and income, if any.



Col. Danforth, Commander of Langley Field

Second Lieut. Danforth was mustered out June 8, 1899, and three weeks later enlisted as a private—enlisting had become an incurable habit by that time. He had heard that joke pulled by Napoleon about every soldier having a Field Marshal's baton in his knapsack—though promotion is rather more certain if your father-in-law happens to have some political influence in Washington. While you can't keep a good man down, knowing the right people has never been a handicap.

Private Danforth fought the Moros, when he could find any, rising to Battalion and Regimental Sergeant Major, again becoming a Second Lieutenant, this time in the 31st Infantry, United States Volunteers. When the 31st returned to the States for muster out, Danforth was left behind in charge of the Military District of Baganga, Mindanao, with one civilian teamster and four mules to enforce the laws of the United States in a district that extended 200 miles along the coast, and as far back in the mountains as one Second Lieut., a civilian teamster, and four mules cared to penetrate. This territory was populated by twelve hillside tribes, Moros and Christian Filipinos, and one dozen assorted hula hula dancers. Lieut. Danforth and his four mules regulated intertribal questions, and kept order more successfully than one of his predecessors had done; that chap, when his relief arrived, was found in the top of a cocoanut tree trying to get the monkeys to take a drink of gin from his bottle. Lieut. Danforth probably was out of gin.

He joined the 10th United States Infantry, in Northern Mindanao, as a Second Lieut. and commanded "C" Company in operations against Ladrones in Loculau, Misamis Area. When a Ladrone would peek out from behind a palm tree, Lieut. Danforth would pop out from behind another palm and try to pot him, instantly popping back again—at least, that's about my idea of the campaign: pop out, pop off, pop in again. General Benny

Foulois was in that campaign and coined the famous remark, "Wait until you see the whites of their eyes—then dodge behind a tree."

Second Lieut. Danforth attended the Infantry and Cavalry School at Fort Leavenworth in 1902 and '03, then returned to the Philippines as First Lieut., 17th Infantry, and "operated" against hostile Moros in Jolo, Mindanao, Cagayau and Island of Pata. These Moros were hostile because they couldn't understand why a bunch of Americans should travel all that way just to beat them up. They were as annoyed as we'd be if an army of Moros suddenly rushed out at us from behind the Empire State Building or Frank McKay or other large structure. But the Americans had the same right to capture the Philippines that the Moros have to come over here and capture Wanamaker's store; besides, they were bigger than the Moros, and had more guns. Considering all these things, the Moros finally gave up and surrendered to Danforth and Foulois.

After putting the Moros in their place—under ground in many instances—Lieut. Danforth joined the Army of Cuban Intervention, and told the Cubans where to get off during 1906 and '08. He fixed the Cubans, and made them peaceful, though it turned out later that they didn't want to be fixed, and absolutely resented being peaceful. Now they're shooting and chasing each other around with gay abandon and are happy and broke again, their natural condition.

The next few years found Danforth serving at various places in the United States, and gradually getting promoted, until the clarion call to action sent him to Vera Cruz, Mexico, in 1914. In keeping with our character as the Ed Wynn among nations, we blundered into Mexico and blundered out again, losing nothing but our dignity, as again in 1916, when old Massa Pershing played tiddley-winks with a bimbo named Pancho Villa, while Europe looked up from its war long enough to have a good laugh. Danforth was in that, too, a Lieut. Colonel in the 2nd Minn. Infantry. From Moros to Mexicans was all the same to him, but by this time he was tired of walking—he had walked a whole year with the 34th United States Infantry, getting corns. In January, 1918, he became a Lieut. Colonel in the Aviation Section of the Signal Corps, took flying instruction, and on July 20, 1918, made his first solo. He survived, commanding the Concentration Brigade, 3rd Brigade, and was Executive at Kelly Field until Sept., when he was relieved at his own request and became Colonel of 384th Infantry until December, 1918. Then he commanded Troop Movement Office, Port of Embarkation, Hoboken, and was Chief, Effects Bureau, to Sept. 1920. By this time he had held every grade in Infantry regiments from Private to Colonel, inclusive, except Corporal and Cook.

1920 and '21 found Colonel Danforth at Primary and Advanced Flying Schools. He graduated from the Bombardment Course, but adopted Pursuit as a matter of choice—being too young and snappy for a bomber—and has stuck to that branch. He commanded Langley Field from 1921 to 1924, was Air Officer, 4th Corps Area, Atlanta, until 1928; commanded Selfridge Field to 1930; and was appointed Brigadier General, Air Corps, July 1, 1930, and assigned Command of Air Corps Training Center, San Antonio, Texas. At the end of his four-year period, on June 30, 1934, he reverted to his permanent rank of Colonel, and now again commands Langley Field, famous as the home of the NACA and the world's largest wind tunnel—which is big and windy enough to test Huey Long.

* * *

● BILL WHEATLEY, Chief Test Pilot of Consolidated Aircraft Corp. of Buffalo, was born at Chester, N. Y., Dec. 17, 1902. Whether there was more rejoicing, or less, in the Wheatley household that Christmas, the record does not state; but according to Chester folklore the Stork was observed decamping rapidly from the Wheatley homestead, and Mr. Wheatley was seen staring angrily after it, with a shot-gun clutched in his hands. Nor is this to be wondered at, for each Christmas the head of a household bolsters up his fortitude to withstand the dismal shock of Yuletide ties and 5-cent cigars, and therefore has no reserve buoyancy to meet further disaster: sock him with a seven-pound baby, and you floor him instantly. Mr. Wheatley, it was said, sort of soured on the Christmas season thereafter, and put wire netting over the chimney.

Be that as it may, Bill followed the standard rule of all Christmas presents, in that he was practically useless to the recipients. The family, which was a very respectable one that ran mostly to school teachers and professors, was pained, hurt, and grieved to notice that as Bill grew up he became gradually greasier and dirtier through working on the embryonic automobiles of his youthful days. He started this grimy pursuit at an early age, with unbounded enthusiasm; thus it was easy for older mechanics to foist off on him the dirtier jobs which covered him from head to foot with oil and grease. In fact, it was the belief of the Wheatley clan that the mechanics wiped the engines off with young Bill.

"Aviation Day" Willie Wheatley

At this period of his career, Bill tells me, he was completely happy and would have been content to remain a jolly grease-ball to the end; but the many family advisers who yearn to leap out at a young man and thrust him upward, got at Bill and filled him with vague desires for a Career; the upshot of which was that he went to Pratt Institute to delve into the mysteries of electrical engineering, and to Cooper Union Night School to master the details of motor vehicle testing and design. This was in 1922, and so hungry for information did he become that he was an easy victim for an Alexander Hamilton Institute salesman who sold him all the world's knowledge, in 24 volumes. That was in 1923; by now Bill has read almost half way through volume one, sometimes reading as much as a sentence a day.

Solidly packed with electrical and automotive knowledge, Bill got out and looked for a job. Although there was no noticeable depression just then, there was no electrical position open, and so far as motor design was concerned, the automobile magnates apparently were content to muddle along without Bill's help. Everything appeared black, including Bill, who returned to his happy occupation of grease-ball. But it's hard to keep a good man down, as the cannibal remarked after he had eaten a missionary, so Bill at last got a fine job as experimental testing laboratory assistant in the engine department of the Mack Truck Co. Before he had found out what, if anything, was the matter with the engines, an examination he had previously taken bore fruit: he received a letter from the War Department ordering him to report forthwith at Brooks Field, Texas, as a flying cadet. He received that letter at 10 a.m. and at 4 p.m. was on his way, leaving the Mack Truck Co. disconsolate. They bore up under the loss, however, and even continued to build trucks, while Bill went onward and upward; on March 13, 1926, he was one of the 18 graduating survivors of an original class of 132 hopeful aspirants.

Decked out with a reserve commission and A.P. and A.O. rating, Lieut. Wheatley immediately accepted a position with Mercury Aircraft at Hammondsport, N. Y., as pilot, instructor, draftsman, truck driver, and airport landscape gardener (he used to cut the hay). Like all

(The rest of this yarn is on page 77)

ACTIVITY AT THE SCHOOLS

New Courses Being Offered

A NUMBER of new subjects have been added to the Radio-Instrument and Executive-Management courses at the Spartan School of Aeronautics, Tulsa, Okla., making these courses available as complete units and not included with any except the Regular and Special Transport Courses.

A specially-designed radio receiver and transmitter, recently completed for the Radio Division will be operated as part of the equipment in the amateur broadcasting station, soon to be installed at the school. This added equipment will give Spartan students the opportunity to receive practical and theoretical radio instruction.

In addition, two new planes have also been added to the flying equipment.

A new course in commercial air transportation, designed especially for adults interested in the business and educational implications of aviation, will be offered by New York University in the School of Education during the spring semester starting February 6, with William E. Berchtold, formerly Manager of the Air Transport Section of the Aeronautical Chamber of Commerce of America, conducting the new course.

A complete survey of the economics of air transportation will be offered by Northwestern University in its evening school of commerce in Chicago beginning this month, according to Dean Ralph E. Heilman. Thomas Wolfe, district manager of United Air Lines, will be the instructor. The survey takes up the history, development, and probable future trends of air transportation, the organization and management of airlines, investment problems and traffic control.

Ground work in aviation is being offered by the Tulsa, Okla., public night school, with W. S. Collier, in charge of the class. The course covers general aeronautics and takes up airplane design and construction, and the modern air-cooled engine. Maps and compasses are studied to determine the deviation and variation of craft, and navigation by dead reckoning. Aeronautical law and meterology are also part of the course.

With the recent addition of a Boeing 40-B type Hornet-powered mail-passenger plane, fully equipped with radio, flight and navigation apparatus, to the training fleet of the Boeing School of Aeronautics, Oakland, Calif., flight instructors at this school are now giving students training in landing on the beam.

The school's fleet now includes three planes which are equipped for instrument flying.

31 New Students at Boeing

SIXTEEN STATES of the union and Canada were represented by one or more students in the class of thirty-one that enrolled for aeronautical training at the Boeing School of Aeronautics, Oakland Airport, Oakland, Calif., in January. The training these students plan to take extends from a period of nine months to two years.

It is interesting to note that of the ninety-six students who were graduated from various courses during 1934, 72 per cent received positions in the aviation industry. Aeronautical Science was added to the Ground School Department of the school to impart fundamentals of physics as applied throughout the work in the various aeronautical courses to those students who lack the required preparatory training in this field.

Instructor Moves to Texas

RAY KUHL, flying instructor who has conducted schools during the last year at South Bend, LaPorte and Michigan City, Indiana; and at Sturgis, Benton Harbor and St. Joseph, Michigan, has taken his equipment to Port Arthur, Texas, where he is operating a school during the winter months.

Kuhl has conducted flying instruction from the Bendix Municipal Airport, South Bend, with regular classes held in nearby cities.

Burnham Heads Tri-State Unit

PROF. WALTER BURNHAM of Wichita, Kansas, has been chosen head of the aeronautical department of Tri-State College at Angola, Indiana, to succeed the late Prof. Luther A. Ott Prof. Burnham has been connected with the college for some time and designed and constructed the wind-tunnel there.

Recently student groups from the Central High School, South Bend, Ind., Aero Club, from the aeronautical classes of the Central and Riley high schools, and from the industrial engineering class of Purdue University, inspected the equipment and facilities of the college.

Parks Enrollment Increases

REGISTRATION OF students for the winter term at Park Air College, East St. Louis, Ill., shows a total enrollment for the term starting January 7 of 200, compared to 107 one year previously.

The engineers of the school recently organized the Engineer's Club as an educational organization to broaden the scope of their work. They elected W. C. Richardson, president; C. Pfrommer, vice-president; W. H. Cannon, secretary and treasurer, and Francis Shaughnessy, Captain of Athletics.

270 Students at Casey Jones School

IN HIS annual report to stockholders, Casey Jones, president of the Casey Jones School of Aeronautics, Newark, N. J., reported that the school now had an enrollment of 270 active students, and that the balance sheet for the fiscal year ending January 1, showed a profit on operations.

PRIVATE FLYING AND CLUB NEWS

Oil Men Tour Country

EIGHT MEMBERS of the Socony-Vacuum Oil Company's Aviation Division, in three of the company's planes, a new Beechcraft, a Stinson Reliant and a Bellanca Skyrocket, are now on a coast-to-coast tour to introduce the 1935 line of Socony-Vacuum's new aviation products, and also make a business survey of the country.

The trip is a sequel to a European tour recently completed by W. L. Faust, general manager of Socony-Vacuum's Aviation Sales Department and H. J. White, aviation sales manager, who, in the Beechcraft, visited the aviation centers of Europe, introducing the new Aero Mobiloil.

In addition to Mr. Faust and Mr. White, the Socony-Vacuum group making the present trip includes H. W. Lake, domestic manager; Julian Dexter, sales engineer; W. Holbrook, R. W. Brown, H. F. Tarbox and L. A. McVey, members of the Aviation Sales Department.

Women's Flying Club Formed

THE BUSINESS Girls Flying Club has been formed in Boston, Mass., to reduce the rates for instruction and solo work so that women may economically learn to fly. It is also hoped to stimulate interest in aviation among women.

The Club is using an Aeronca, and John H. Shobe of the East Boston Airport, and Alfred Lecksheid, are instructing.

Organized only recently by Miss Louise A. Wheeler, five of the fifteen active members have already soloed.

(*Continued on following page*)

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(Continued from preceding page)

Crowds Attend Miami Races

THREE DAYS of air events came to a close January 12 when the annual All-American Air Races concluded a most successful program at the Miami Municipal Airport where close to 50,000 persons gathered to witness speed races, acrobatic flying, parachute jumps, and exhibition flying by private and military craft. More than 300 military planes concentrated there, performing maneuvers and stunt flying, led by the "Men on the Flying Trapeze."

Winners of events follow:—First day: Clarence McArthur, 200 cu. in. displacement, Church-powered Tillbury Flash; Dwight Cross, 375 cu. in. displacement, Kinner-powered Davis; Art Davis, 550 cu. in. displacement, Davis Special. Second day: Roger Don Rae, 550 cu. in. displacement for Green Trophy, Menasco-powered Keith Reider; Ben Stegall, 800 cu. in. displacement, Wright-powered Travel Air; Alton E. Sherman, 550 cu. in. displacement, Cirrus-powered Cessna. Third day: Jack Wright, 550 cu. in. displacement (cabin planes), Warner-powered Monocoupe; Art Chester, free-for-all for Venezuelian Trophy, Menasco-powered Chester Special; B. Stegall, free-for-all, Wright-powered Travel Air; Larry Hughes, sportsman pilot race for Macfadden Trophy, free-for-all, Waco.

Acrobatic flying by Capt. Al Williams, Miss Helen McCloskey and Art Davis: soaring exhibitions by Richard C. duPont; and parachute jumping by Clem Sohn, rounded out the program.

Buffalo Club Elects Directors

SEVEN MEMBERS of the Buffalo, N. Y., Aero Club were elected to the Board of Directors at a recent meeting. They are Ralph S. Damon, president and general manager and Burdette S. Wright, vice-president of Curtiss Aeroplane & Motor Corp.; Raymond S. Madison, secretary-treasurer and Clinton P. Warner, sales executive of Consolidated Aircraft Corp.; Dr. Roy L. Scott, John W. Van Allen and George Lyon.

Club Plans Plane Purchase

THE AERO Club of South Jersey is making extensive plans to expand its activities.

According to Joseph N. Hettel, Jr., operations are conducted from a 200-acre tract bordering on the Rancocas Creek. Alterations on a house on the grounds will provide accommodations for club activities. The club plans to purchase a light plane for instruction to be given at nominal cost.

Hunt Heads Air Police

ROY O. HUNT of Oklahoma City, was recently sworn in as a deputy sheriff to head Oklahoma's newly-formed air police unit. Sheriff Rogers of Oklahoma County plans to organize all counties of the state so airplanes could be available to chase bank robbers and other bandits. He stated that he planned cooperation with these air units and planned to have a plane equipped for two-way radio so officers on the ground could be directed in a chase for law-breakers. A four-passenger cabin plane was bought, part of the money being donated by several Oklahoma City business men.

Vurpillat on South Bend Board

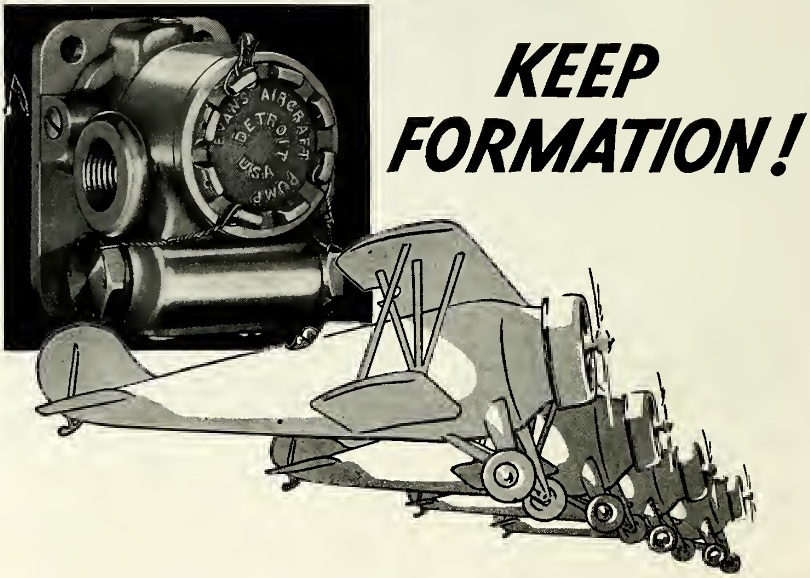
DR. F. J. VURPILLAT, secretary of the Arup Manufacturing Co., has been appointed a member of the South Bend, Ind. city aviation commission.

Group Flies 270 Hours

SEVEN MONTHS after it was formed, the Aero Sportsmans Club, Inc., of Akron, Ohio, logged 270 hours in its Kinner-powered Hammond biplane. Seventy-eight hours of this time was dual.

The group is composed of 20 members, all business or professional men, with Ray Grenzou, president; A. Kent Clark, vice-president; and A. D. Miller, secretary-treasurer. R. F. Kitchingman and Blake Cahill are the instructors.

A second group will be formed and another plane purchased in the near future.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AIRLINES AND AIR TRAVEL

Airline Progress in 1934

REPORTS FROM transport companies for 1934 indicate vast expansion programs were carried through to completion despite the uncertainty existing during the air mail cancellation period and the low rates under which new air mail contracts were let. Traffic figures, generally, were ahead of 1933, but returns were not sufficient to meet operating deficits caused by the low pound mile basis of pay received.

United Air Lines carried 147,000 paid passengers, 15 per cent more than the previous year; 1,136,000 pounds of express and 3,000,000 pounds of mail were flown in United planes, all of which flew about 15,000,000 miles during the year. At the end of the year, the company was flying ten Boeing 247-D transports and was converting its entire fleet of 247's to the 1935 model, thus providing greater speed, more effective cabin soundproofing and more efficient ventilation.

Eastern Air Lines completed an equipment program which saw 14 Douglas airliners placed in service on its three routes. Previously operating the Atlantic coast route from New York to Miami, the company's routes were extended by a New York-New Orleans and Chicago-Miami service, increasing its route mileage from 2,025 to 3,755. American Airlines also re-equipped its fleet by purchasing a number of Vultee and Douglas transports, while TWA, Inc., flying Douglas transports, inaugurated overnight coast-to-coast service. Other airlines purchased new and faster equipment, namely Northwest Airlines, which is flying Lockheed Electras; and Pennsylvania Airlines, Alfred Frank and General Air Lines, Boeing transports.

Personnel Changes

CAPT. E. V. RICKENBACKER became general manager of Eastern Air lines early last month, but retained his vice-presidency in North American Aviation, Inc., the parent company. At the same time, Paul Brattain was promoted to the position of assistant general manager of the airline and vice-president of North American Aviation. In other promotions John K. Ottley, Jr., was transferred from Atlanta to New York as assistant general traffic manager; E. E. Skinner became northern division traffic manager; and S. D. Wilkes, southern division traffic manager.

Chicago and Southern Air Lines appointed W. I. Gates, formerly of TWA, as operations manager and Ole May joined Palm Springs Airlines as general traffic manager. The election of Harold Crary, director of public relations and traffic for United Air Lines to the vice-presidency was also announced.

Operators Move Headquarters

LOVE FIELD, Dallas, Tex., became the central operations point for two more airline companies when Bowen Airlines and Braniff Airways established new headquarters there.

Fifty persons were included in the Braniff transfer, including Raymond C. Shrader, operations manager, S. E. Perry, maintenance superintendent, and their staffs. Coincident with the move, Braniff disclosed plans for acquiring a fleet of Lockheed Electras for a night schedule on the Dallas-Chicago route.

Bowen moved into new quarters in the Airport Utilities Building from the old United hangar, at the same time announcing schedules which connect with American Airlines and other companies operating out of Dallas.

Flight Operations Predetermined

A NEW flying routine which enables the transport pilot to decide one hour in advance of scheduled flights the course, the most favorable altitude and the percentage of horsepower to be used in making a scheduled flight, was revealed by TWA, Inc.

Company regulations require a meeting of the pilot, dispatcher and meteorologist one hour before the transport plane leaves each terminal or control point. These men make a detailed study of the weather maps for the twelve preceding hours and determine weather conditions under which the flight will be made. Based upon a study of these factors the pilot plans his flight which includes course correction for winds, most favorable altitude at which to fly, and the required power to be used from the engines to complete the flight on schedule.

38,954 PASSENGERS FLEW DURING NOVEMBER

SCHEDULED AIR lines operating in continental United States carried 38,954 passengers in November, 1934, according to reports to the Bureau of Air Commerce, Department of Commerce, from 20 of the 21 companies operating during that month. They flew 3,438,832 miles, carried 192,132 pounds of express, and flew 17,194,538 passenger miles.

New Schedules Announced

FASTER AND more efficient service is being rendered by American air transport companies as a result of coordination of schedules and the introduction of new equipment.

Daylight mail and passenger service to Los Angeles and night service to New York are being offered by American Airlines out of Dallas, Tex., by Post Office expansion of schedules. Dallas-Chicago-New York time was substantially lowered by flying Douglas airliners and making better connections in Chicago, thus saving 2 hours 3 minutes. Flying the alternate southern transcontinental route, planes connect at Dallas for sleeper Condors for Los Angeles.

Accelerated travel is being offered by Pennsylvania Airlines and Transport Corp., between Washington and Detroit, connecting at Cleveland, Pittsburgh and Detroit with planes to the east and west. Boeing transports have replaced tri-motored Fords and three schedules daily, with morning, noon and evening departures from each end of the line, allow several commuting services between principal cities along the route. Central Airlines, Inc., flying the mail over the same route, is now offering new and faster service in improved tri-motored Ford transports.

Eastern Airlines inaugurated new schedules between New York and Miami and started Douglas service for passengers, mail and express between New York and New Orleans. "Florida Flyers" now leave New York at 9:40 a.m. and 9:40 p.m.; departures from Miami are scheduled for 10 a.m., and 8:30 p.m. Eight-hour service is offered on a "skip-stop" arrangement. Opening of the service to New Orleans was featured by a fast 7 hour 8 minute flight from the south to New York.

TWA, Inc., started a non-stop flight service between Chicago and New York, supplementing its three daily trips with this new 4-hour service. The flight is made only from the west to the east, and other planes are scheduled to stop at Philadelphia and Pittsburgh.

United Air Lines inaugurated a third coast-to-coast passenger service so that passengers may fly over the scenic sections of the West during daylight hours. The new service supplements the present overnight flights from Eastern points to Pacific coast cities.

Airlines Serve 53,751,593 Persons

SCHEDULED AIRLINES are directly serving, according to a survey by the Bureau of Air Commerce, 43% of the total population of the United States, as well as three-fourths of the nation's metropolitan districts. The 26,377 miles of domestic air routes are so distributed that they touch 71 of the 96 major population centers.

Airliners Make Fast Flights

PHENOMENAL TIME was made on a number of regularly scheduled flights when favoring January winds enabled passengers to save considerable time in going from one city to another.

Harry Bitterman and John Ames flew a United Air Lines' Boeing with eight passengers and a cargo between Chicago and Cleveland in 1 hour 23 minutes, averaging 230 m.p.h.

Joe Westover averaged 249.6 m.p.h. between St. Louis and Chicago in an American Airlines' Vultee and brought eight passengers 258 miles in 1 hour 2 minutes.

Inauguration of non-stop service between Chicago and New York by TWA was featured by a 266 m.p.h. flight which brought the Douglas and 14 passengers to New York in 3 hours 15 minutes. R. S. Leroy and C. E. Robey were at the controls. Another fast flight in a Douglas brought Miami and New York 6 hours 34 minutes apart. Richard Merrill and E. A. Barber flew the ship which carried 12 Eastern Airline passengers at an average speed of 183 m.p.h.

Air Mail Contract Changes

NOT SINCE the cancellation period has there been as much shifting about of air mail contracts as in past weeks.

The Post Office Department transferred the contract for the Chicago-Pembina route from Hanford Tri-State Airlines to Northwest Airlines, and designated the Chicago-Seattle run as one of the four transcontinental routes. Two schedules will be operated, the second being inaugurated upon the completion of installation of lights and radio range beacons. Hanford will continue operating the Twin Cities-Kansas City line under contract and plans to augment its present equipment with modern transports.

Braniff Airways expanded by purchasing, from Long and Harmon, the contracts and equipment for the Dallas-Waco, Waco-Galveston, Waco-Brownsville and Fort Worth-Amarillo mail routes. The purchase which enables Braniff to offer a direct service between Chicago and Brownsville, means the retirement of Long and Harmon from the transport field, but they will continue their aviation school in Dallas. Braniff, now flying 5,000 miles daily, will maintain headquarters in Dallas.

Due to the illness of F. H. Robertson, its president, the Robertson Airplane Service Co., sold the mail contract covering the New Orleans-Houston route to Wedell-Williams.

Pacific Seaboard Air Lines, Inc., changed its name to Chicago and Southern Air Lines. At the same time, D. D. Walker was elected secretary and the company announced plans for the inauguration of night service over its Chicago-New Orleans route.

A temporary air mail contract was awarded to R. Bennett of Boise, Idaho who will fly the mail between Pinedale and Jackson, Wyo.

AT THE AIRPORTS

Airport Classification Simplified

A SIMPLIFIED system of airport classification which became effective January 1, provides that only airports serving scheduled interstate airlines will be examined for compliance with Bureau of Air Commerce requirements.

Airports meeting the requirements for scheduled air transport operations will be designated on the Bureau's air navigation maps and Airway Bulletins by the use of the letter *T*, and airlines will operate only from those airports which have met these requirements, except in emergencies or where the Bureau of Air Commerce has granted a waiver for such use.

Utilities having hangar facilities and service for aircraft will be referred to as airports; those having landing areas and no hangar facilities or service for aircraft will be called landing fields.

The Bureau hopes that examination and classification of airports other than those used by the airlines will be undertaken by the states and it will publish a suggested draft of airport requirements, setting up not more than 3 or 4 classifications to serve as a guide. A few states have already taken steps along the lines suggested by requiring all airports within their borders to hold state licenses.

Tulsa Busy in 1934

THE 1934 traffic report of the Tulsa Municipal Airport submitted by C. W. Short, Jr., manager reveals that 73,200 persons arrived at or left from the field in 14,600 planes. Since the airport was opened in 1928, more than 523,000 people have cleared the port.

Never having lost money, the Tulsa field represents an investment, including equipment and planes stored, of $1,650,000; it consists of 405 acres completely equipped with night lighting and weather broadcasting facilities, a radio range and beacon station and has an A-1-A rating which it is hoped will be superceded by an A-T-A rating this spring.

Varied Improvements Continue

LITTLE LET-UP in the construction of new facilities and further improvements at airports throughout the country is in evidence as reports continue to show definite activity along these lines.

At Little Rock, Ark., the long-awaited PWA loan for the construction of a hangar at the municipal airport has been received and work will get underway in the near future. The building program at Idaho Falls, Idaho, is rapidly nearing completion and when finished will provide widely-improved facilities. The new administration building will be of stone, two-stories high and will provide a waiting room, offices and living quarters for field attendants; the new hangar will include repair shops and accommodations for five or more planes.

Klamath Falls, Ore., purchased twenty additional acres for municipal airport expansion; the Nashville, Tenn., Board of Public Works received bids on a $3,200-hangar measuring 100′ × 60′ for McConnell Field and plans to charge $5 a month for rental; and Chesepeake, Ohio, is preparing to spend $25,000 for concrete runways, and an administration building.

Bids for a contract for enlargement of the Cleveland administration building and ticket office have been asked, with the city ready to spend $25,000.

The improvement program rapidly nearing completion at the Schenectady County Airport, Thomas Corners, N. Y., includes the installation of four 3000′ runways, a concrete apron and lighting facilities. A new road has been constructed, hangars overhauled and living quarters for pilots installed. So extensive is the work that when finished, the field will be one of the finest in its section.

North Beach Taken Over by New York

EXPANDED AIRPORT facilities for the city of New York were pledged by Mayor LaGuardia as he formally accepted and dedicated to the city, Municipal Airport 2, the former Glenn Curtiss Field at North Beach, Queens. Receiving the keys to the field from W. S. Leaycraft, president of Curtiss-Wright Air Terminals, Inc., from which the city has leased the project with an option to buy, the Mayor revealed plans for studying two airport sites in the Bronx and efforts toward turning over Governors Island for a city air terminal.

T. Park Hay of TWA, Inc., gave the Mayor a lease whereby his company will use Floyd Bennett Field where it intends to base when hangar improvements are completed and following a number of addresses by Dock Commissioner McKenzie, Aviation Commissioner Zelcer and Borough President Harvey, passengers were taken aloft in a Douglas airliner and a Boeing transport. Flight exhibitions were provided by Al Williams and George Burrell. During the ceremonies, Roscoe Turner and Clyde Pangborn arrived in their MacRobertson-Race Boeing transport.

TWO JUMPS AHEAD

ONE YEAR

. . . ago this month the first announcement was made of the 225 h.p. Beechcraft. *It was stated that this new airplane would out-fly, out-perform any airplane in its class.* The Beechcraft has made good! Each new Beechcraft adds weight to these statements. And now others are trying frantically to imitate the outstanding performance of the Beechcraft.

BEECHCRAFTS FOR 1935—THE FOLLOWING CRUISING PERFORMANCE IS GUARANTEED:

Engine	Propeller	Cruising H.P.	Cruising Speed (M.P.H.) and Altitudes		
Jacohs L-4	Wood	175	150 Sea Level	157 at 5000 Feet	161 at 7200 Feet
	Curtiss	175	155 Sea Level	162 at 5000 Feet	166 at 7200 Feet
Wright R760E-1	Wood	210	160 Sea Level	168 at 5000 Feet	172 at 7200 Feet
	Curtiss	210	165 Sea Level	173 at 5000 Feet	177 at 7200 Feet
Wright R760E-2	Wood	220	162 Sea Level	170 at 5000 Feet	176 at 8600 Feet
	Curtiss	220	167 Sea Level	175 at 5000 Feet	181 at 8600 Feet

P.S. Orders for 12 Beechcrafts were placed the first week of 1935. The Beech plant is operating on a capacity schedule. Order your Beechcraft early to avoid inconvenience and delay.

The BEECH AIRCRAFT CO., Wichita, Kansas

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- RESTORES CHECKED AND CRACKED AIRPLANE FABRICS
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ENGINES AIRPLANES ENGINES PROPELLERS

THE INDUSTRY IN GENERAL

Martin Boat In Further Tests

SEVERAL SUCCESSFUL test flights have been made by the Martin Flying Clipper No. 7, the flying boat built by the Glenn L. Martin Company of Baltimore, Md., for Pan American Airways, since its initial test and maiden flight last December. On its last test, the ship carried some 2,800 gallons of fuel which brought the total weight to approximately 40,000 pounds. Officials of the Martin company and test pilots have been gradually increasing the weight in tests and putting the ship through extensive maneuvers, both on water and in the air. W. K. Ebel, Martin's chief test pilot, has been at the controls in these flights.

On one of its recent flights, experiments were made with a device designed to keep a pictorial log of each trip. Two cameras, attached to tripod brackets fastened to the ceiling took numerous pictures of the instrument panels in the pilot's cockpit and in the mechanic's compartment, making a record of the readings. On completion of the flight, the films, when developed, reveal a pictorial log, giving altitude, speed, weight of fuel, heat of engines and other data as indicated by the instruments at a particular moment.

Trippe Heads Aviation Relief Drive

FOR THE fourth consecutive year, J. T. Trippe, president of Pan American Airways, will head the representation of the aviation industry in the annual campaign for relief funds. Each year the Aviation Committee was the first to reach their quota and in the current campaign, exceeded by nearly 100% the amount allotted to the aviation industry to raise. Serving with Mr. Trippe on the Aeronautics Division Committee of the Citizens' Family Welfare Drive, were: E. R. Breech, president, North American Aviation, Inc.; Thomas A. Morgan, president, Curtiss-Wright Corporation; S. M. Fairchild, president, Fairchild Aviation Corp., and Grover Loening, president, Loening Aviation Corp.

United Aircraft Men Honored

REX B. BEISEL, assistant chief engineer of the Chance Vought Corp., and A. Lewis MacClain, chief test pilot for the Pratt & Whitney Aircraft Co., co-authors with F. M. Thomas, of the Research Division of the United Aircraft Corp., of a paper on the *Cowling and Cooling of Aircraft Engines* were presented with the Wright Brothers Medal and the Manly Memorial Medal by the Society of Automotive Engineers in Detroit on Thursday, January 17. The awards were made in acknowledgment of the outstanding technical value of the paper which was recently presented before a meeting of the Society. A resumé of the paper appeared in the June, 1934 issue of AERO DIGEST.

This is the first time in the history of the awards that both have been given for the same paper.

Post Aircraft In Production

WITH EXPERIMENTAL work completed and the factory running satisfactorily, the Wiley Post Aircraft Corp., Oklahoma City, is ready to begin commercial sales, according to Thomas J. Ruddy, manager. The new ship will retail at $1,692, flyaway factory including instruments and other equipment. The factory is employing 22 men, but the payroll will include more than 40 as soon as the sales force is completed.

Curtiss-Wright Shows $490,521 Profit

CURTISS-WRIGHT Corporation and subsidiaries for the third quarter of 1934 reported a net profit of $490,521 after charges and taxes, as against $299,287 in the second quarter and $154,376 in the September quarter last year.

For the first nine months net profits were $584,829, compared with $582,450 in the same 1933 period.

Kellett Moves To New Factory

ADMINISTRATIVE AND shop activities of the Kellett Autogiro Corp., were consolidated in one building when the company moved into a new plant in Philadelphia. Extensive alterations have provided 30,000 square feet of space and the factory has been equipped to turn out 100 or more ships a year.

At present, Kellett is preparing to submit bids for the first autogiros of the direct control type to be purchased by the Army, the bids to be opened February 14. No change in personnel was entailed in the move. W. Wallace Kellett is president; C. T. Ludington, vice-president; R. G. Kellett, secretary-treasurer and general manager and R. H. Prewitt, chief engineer.

Jacobs-powered direct control Kellett autogiro

More Approvals Issued

APPROVED TYPE Certificates covering two aircraft engines were issued by the Department of Commerce as follows:

Wright Aeronautical Corp., Paterson, N. J., model SR-1820-F42, a 9-cylinder, radial, air-cooled engine rated 635 h.p., at 1950 r.p.m., at 8000 ft. 73 Octane fuel required. ATC 133.

Menasco Manufacturing Co., Los Angeles, Calif., model Pirate C45, a 4-cylinder, in-line, inverted, air-cooled engine rated 150 h.p. at 2260 r.p.m., at 3000 ft. 73 Octane required. ATC 134.

In addition, Bendix Products Corp., South Bend., Ind., received an approval on the type C low-pressure, magnesium cast, 15.00-16 landing gear wheel, which has an approved static load of 10,200 lbs.

Flight tests were conducted recently at the Edo Aircraft Corp., plant, College Point, Long Island, N. Y., on a Waco WHD equipped with Edo model 39-4000 floats and powered by a Wright 420 h.p. engine. Following the flight, the plane was licensed as a seaplane; it can be converted into a military two-place fighter or sport plane.

The Waco is the first plane to be tested on the recently-developed 39-4000 floats which have been added during the last few months to the Edo line of streamlined, high-speed models.

Government approval of the Flyabout manufactured by the Porterfield Aircraft Corp., Kansas City, has been received, according to E. E. Porterfield, president.

Porterfield reported his company ready to go into immediate production on a large scale and said orders on hand total more than 150. Several ships already have been sold including one in Balboa, Panama. The Flyabout is powered with either the LeBlond 70 h.p. engine or the Velie 65 h.p. engine and has a top speed of 120 m.p.h.

Gross, Damon Elected Presidents

ROBERT E. GROSS has been elected president of Lockheed Aircraft Corp., Burbank, Calif., succeeding Lloyd Stearman, who resigned to devote his time to aeronautical research. Gross, in addition to being president, is also chairman of the board and treasurer.

Carl B. Squier, vice-president and sales manager, was elected to fill a vacancy on the Board of Directors.

Another report of importance came from Thomas A. Morgan, president of the Curtiss-Wright Corp., who announced the appointment of Ralph S. Damon as president of the Curtiss Aeroplane & Motor Corp., of Buffalo, N. Y. Mr. Damon now is president of all the aircraft manufacturing subsidiaries of the parent company, including the Curtiss-Wright Airplane Co. in Robertson, Mo.

Plane Sales Reported

FIVE MORE *Electras* have been ordered by Northwest Airlines, Inc., from the Lockheed Aircraft Corp., Burbank, Calif., to bring the total number of Electras ordered by the airline to thirteen. The first order was for three Electras, and it was followed by an order for five more. The fifth Electra of this total of eight was recently delivered to Northwest Airlines for extending its service in the northwest. When their last order has been filled, the line will double its transcontinental service. The last ship is expected to be delivered in the spring, about the same time that the new beacon service along the Seattle - Chicago route is finished. The Post Office Department recently granted Northwest Airlines a second transcontinental air mail schedule, to go into effect shortly.

A twin-Wasp Boeing 247-D passenger plane has been delivered to Marshal Chang Hsueh Liang of China for his personal use, by the Boeing Aircraft Co., Seattle, Wash.

Marshal Liang has charge of the Hupeh province of the Nanking Government and will use the plane in covering his far-flung domain. Julius Barr, former United Air Lines pilot, will fly the transport.

The plane is a standard model except for special club car facilities which include lounges and chairs.

Acme photo

Jimmie and Mrs. Doolittle who flew from Burbank to New York in less than 12 hours

Waco Sales, Inc., of Roosevelt Field, Garden City, N. Y., has sold a Waco model A, powered by a Jacobs engine to Sabin Carr of Lake Placid, N. Y.

Lambert Company Reorganized

J. D. WOOSTER Lambert has taken over the presidency of the Lambert Aircraft Corp., Lambert-St. Louis Municipal Airport, St. Louis, replacing P. R. Beasley. The property, formerly known as the Monocoupe Corp., was purchased last May from the estate of the late Phil deC. Ball by a St. Louis syndicate which included Lambert and Harry Hall Knight. Beasley, formerly head of the Detroit Aircraft Corp., became head of the Monocoupe Corp. in October, 1933, and continued in that capacity until Jan. 10.

New officers chosen are J. C. Nulsen, vice-president and general manager; C. W. Bunch, sales manager; and T. Towle, chief engineer.

Large Stock For Disposal

CHARLES FROESCH, formerly in charge of service and sales engineering for General Aviation Manufacturing Corp., has been employed by North American Aviation, Inc., to have charge of selling $100,000 worth of airplanes, engines and spare parts.

Maintaining headquarters at New York and Atlanta, Mr. Froesch will endeavor to dispose of 17 airplanes, 12 engines and several thousand dollars worth of spare parts. The airplanes include Curtiss-Condors, Mailwings and Kingbirds.

Digest of Recent Events

Argentine Transport Record Broken

THE PAN American Grace Douglas transport *Santa Lucia* established a new record during a flight between Mendozan and Buenos Aires by covering the distance in 3 hours 20 minutes at an average speed of 189.5 m.p.h. The *Santa Lucia* also holds the commercial plane altitude record as the result of its recent flight to 29,800 feet over Lima, Peru. JAN. 3

Ellsworth Discovers Five New Islands

FIVE ISLANDS, three fjords and several mountain peaks not marked on the latest official charts are some of the discoveries made during the flight of the Northrop *Polar Star* flown by Bernt Balchen and Lincoln Ellsworth over the Antarctica. The *Polar Star* took off with a gross weight of 6,798 lbs. and remained in the air 2 hours 28 minutes, averaging about 160 m.p.h. before the return to the base at Snow Hill Island, Antarctica. JAN. 4

Frisco-Chicago Transport Time Lowered By United

LARRY HOLSINGER, United Air Lines' pilot, established a new transcontinental plane speed record between San Francisco and Cleveland when he flew a twin-engined Boeing transport with nine passengers and 139 lbs. of mail at an average speed of 201 m.p.h. for an elapsed time of 11 hours 38 minutes. The speed into Chicago from San Francisco was 9 hours 55 minutes, cutting 20 minutes off the record. JAN. 7

Amelia Earhart Flies Pacific On Solo Flight

THE FIRST solo flight ever made, either east or west, between Hawaii and the North American continent was accomplished when Amelia Earhart Putnam landed her Pratt & Whitney Wasp-powered Lockheed Vega at the Oakland, Calif., airport after flying 2408 miles from Wheeler Field, Hawaii. The trip consumed 18 hours 16 minutes and was featured by almost continuous radio communication between the plane and ground stations. JAN. 11-12

Doolittle Spans U. S. In 11 Hours 59 Minutes

A NEW transcontinental speed record was made by Major James H. Doolittle, aviation manager of the Shell Petroleum Corp., when he flew an American Airlines' Cyclone-powered Vultee transport from Burbank, Calif., to Floyd Bennett Field, Brooklyn, N. Y. in 11 hours 59 minutes, surpassing by nearly 5 minutes the former transport time. Major Doolittle flew over Floyd Bennett Field touching his wheels on the ground and then continued on to Newark Airport where he landed. The record for racing planes between the two coasts is 10 hours 2 minutes held by Col. Turner. JAN. 15

Women's Speed Mark Set By Miss McCloskey

USING THE Warner Super-Scarab-powered Monocoupe flown by Jack Wright in the MacRobertson Race, Miss Helen McCloskey set a women's speed record of 166.67 m.p.h. for a 100-kilometer course at Miami, Fla. There previously has been no record in this category. JAN. 15

Douglas Sets Chicago-N. Y. Record

FLYING AT 10,000 feet and aided by a 60-mile tail wind, a Douglas transport carrying 14 passengers for TWA, Inc., completed a Chicago-New York flight in 2 hours 54 minutes, the fastest time yet made between the two cities in any type plane. JAN. 17

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15 Planes, 82 Engines Exported

STATISTICS ISSUED by the Department of Commerce for exports of aeronautical equipment show that foreign purchasers during November, 1934, spent $1,634,834 for American products. Sales of parts and accessories brought the largest amount, $697,386, and 15 airplanes sold for $360,816; 82 engines represented $577,007 of the month's total.

Russian purchases exceeded others when $649,536 was realized from that country, 38 engines accounting for $362,954 of the total spent. China took the greatest number of planes, 6, valued at $153,620. Together with other purchases, the latter spent $170,735 during the month. The value of Japan's purchases was $119,449 and that from The Netherlands was $83,491.

Other aircraft were sold in Rumania, Switzerland, United Kingdom, Panama, Mexico, Argentina, Brazil and Uruguay More than one engine was shipped to Germany (8), Turkey (5), Honduras (4), Sweden and Mexico 3 each, and Brazil (2).

It is interesting to note that export sales of the Fleet biplane reached record heights during 1934. According to Clinton P. Warner, sales executive of the Consolidated Aircraft Corp., Buffalo, N. Y., foreign orders for the plane taken during the year totaled 102 complete units, equipment and material for 20 to be manufactured under foreign license and approximately 15 equivalent airplanes in spare parts. Twenty-five were equipped with the British deHavilland Gipsy Major while 97 were or will be equipped with Kinner engines.

The corporation entered 1935 with orders for 31 complete planes, plus equipment and material for 20 additional.

Ryan Production Speeded

UNDER THE direction of E. G. Nabell, appointed recently as plant superintendent at Ryan Aeronautical Co., all production departments have been placed on a full-time basis. It is expected that deliveries of back orders will be made about the first of this month.

An increase of more than 100 per cent in factory employees has resulted from efforts of the company to keep pace with orders for the new Ryan S-T super-sport low-wing monoplane.

Peter Dana is now at the factory awaiting delivery of an S-T which he will take back to Holderness, N. H., where he will act as distributor for the San Diego, Calif. manufacturer.

Two Vultees Sold

AIRPLANE DEVELOPMENT Corp., Glendale, Calif., has sold Wright Cyclone-powered Vultee transports to the Superior Oil Company of Los Angeles and the United Gas Public Service Co., of Houston, Tex. Both planes are scheduled for immediate delivery, as is the eighth plane for American Airways. The latter is to go into service on the New York-Montreal route carrying mail and passengers on an accelerated schedule..

COMING EVENTS

Bids for the purchase of autogiros will be opened by the U. S. Army Air Corps, War Department. February 14.

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Reserve officers from civilian ranks will receive preliminary examinations from the War Department for appointment to the U. S. Army Air Corps. February 20

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Group and regional meetings of the American Society for Testing Materials will be held in Philadelphia, Pa. March 4-8

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Entries for the Sixth Annual William E. Boeing Scholarships, held by the Boeing School of Aeronautics, Oakland, Calif., close. March 15

•

Final examinations for Air Corps appointments will be held by the War Department. April 2

•

The Intercollegiate Flying Club Air Meet will be held at the Municipal Airport, Northampton, Mass. May 11

•

The Thirty-eighth Annual Meeting of the American Society for Testing Materials will be held at the Book-Cadillac Hotel, Detroit, Mich. June 24-28

Units Dissolved To Obey Law

COMPLYING WITH the Air Mail Act of 1934, two parent companies revised their set-ups and disposed of property which they could not own under the law.

North American Aviation, Inc., chose to become an operating company and accordingly ordered a liquidation payment to stockholders consisting of 279,544 shares of Transcontinental & Western Air stock held by it. At the same time, James H. Kindleberger was elected president of North American Aviation and the company acquired the assets, liabilities and obligations of General Aviation Mfg. Co., of Dundalk, Md. The name of the manufacturing company was discarded and the unit will be known as the manufacturing division of North American Aviation, Inc.

The Aviation Corporation transferred to trustees, for the benefit of its stockholders, stock of Canadian Colonial Airways and American Airlines, Inc. A new company is being organized to acquire the business of Stinson Aircraft Corp., Lycoming Manufacturing Co., aircraft engine division; Smith Engineering Co., and the Airplane Development Corp.

Earhart's Lockheed Vega

THE PLANE in which Amelia Earhart flew from Honolulu to Oakland is a high-wing Lockheed Vega powered by a P. & W. Wasp S1D1 engine that develops 550 h.p. at 5000 ft.

The plane was built in 1931 and subsequently was owned by John Mears and Elinor Smith, from whom Miss Earhart purchased it to replace her trans-Atlantic Vega which is in the Franklin Museum.

The standard Vega normally carries six passengers and a pilot, but on the trans-Pacific flight, the cabin was devoted to extra fuel tanks. Although the normal gross weight of the plane is 4750 lbs., Miss Earhart took off from Wheeler Field with a gross weight of 5800 lbs., including 500 gallons of fuel. The top speed of the plane, with a Hamilton Standard controllable-pitch propeller is 200 m.p.h., but Miss Earhart cruised at 150 m.p.h. to conserve fuel.

Special radio apparatus was in the plane. In addition to a receiving set for beam flying, a special Western Electric transmitter was also carried. Power was generated from an automobile-type generator in the nose of the plane to feed the storage batteries that were near the radio.

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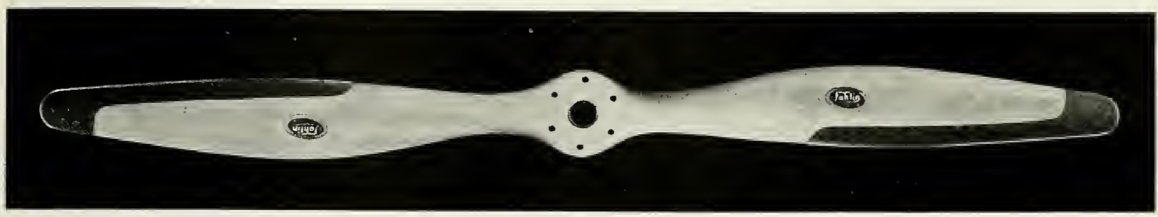

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Aeronca E-107 or E-113	$27.00	Cirrus Hi-Drive	$37.50	Genet 80 H.P.	$40.00
Continental A-40	$27.00	Wright or D. H. Gypsy	$37.50	Kinner K-5 or B-5	$40.00
Salmson 40 H.P.	$35.00	Lambert R-266	$37.50	Tank	$40.00
Szekely Model L or O	$35.00	LeBlond 60 or 70 H.P.	$37.50	Warner Junior	$40.00
Cirrus Mark III	$37.50	Velie M-5	$37.50	Warner Scarab	$40.00
		Curtiss OX-5 or OXX-6	$40.00		

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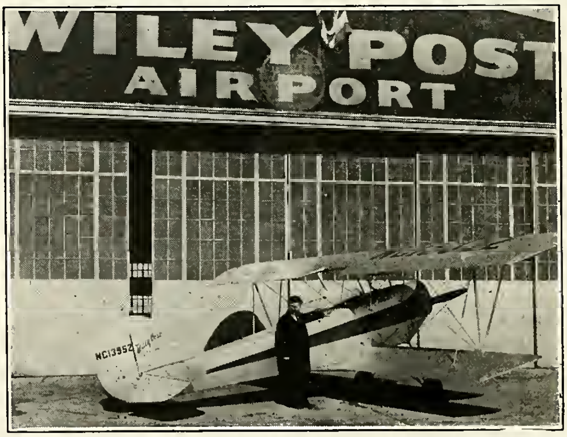

Wiley Post, famous round-the-world flier, points with pride to another aviation triumph—the Wiley Post plane.

THE WILEY POST PLANE

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HERE is the finest lightweight twin-seated dual-controlled ship on the market. It is a Ford-powered craft made for training work or for sportsmen pilots. Dealers wanted who can handle exclusive franchises in their territory. ¶ Wiley Post planes are equipped with a Ford (Model A-converted) engine. Motor repairs can be made without loss of time, for standard Ford parts are available everywhere at a minimum cost. ¶ Wiley Post planes are government-licensed and are submitted to a gruelling inspection before the ship takes off on its initial flight. Write and get the details and you, too, will point with pride to your ship—the Wiley Post. We're sure you will want one, at this low price of $1692.

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WILEY POST AIRCRAFT CORPORATION
Wiley Post Airport, Oklahoma City, Oklahoma

FOREIGN NEWS IN BRIEF

●

Australasia

WITH ARRANGEMENTS completed for the second part of the geophysical survey of the Northern portion of Australia, tenders for the selected areas have already been closed.

The areas to be photographed comprise about 1,000 square miles each in Queensland, the Northern Territory and in Western Australia. The contractor will be required to undertake reconnaissance and inspection flying to the extent of a minimum of 8,000 miles.

AIR MAIL service between Perth and Adelaide, via Kalgoorlie, Forrest and Ceduna will be provided by West Australian Airways, Ltd., which has just obtained the contract to fly over the route. The government is also considering the possibility of extending, as soon as possible, the mail service to Sydney instead of terminating it at Cootamundra.

ARRANGEMENTS FOR a new airport at Gaya, India, in the State of Bihar, have been announced in order to provide a landing and refuelling point for transcontinental planes between Allahabad and Calcutta. The planes now make the Allahabad-Calcutta flight non-stop and the new airport is to be built to enable the planes to carry more pay load and less fuel by breaking the trip at Gaya.

CONSTRUCTION OF the Civil Airport at Singapore is being continued and it is anticipated that will be ready for use in 1936. More than one-third of the work has been completed at a cost of $1,463,000. The construction involves the reclamation of 264 acres and requires about 7,000,000 cubic yards of fill. Upon completion of the project, Singapore will possess a landing field 3,000 feet in diameter and a sheltered anchorage for seaplanes practically in the heart of the city, fully equipped with hangars, workshops and offices.

Diesel Fifty Caterpillar grading the new airport being constructed at Singapore

Canada

WHILE COMPLETE returns for express poundage are not yet available, Canadian Airways, Ltd., the largest operator, carried 5,440,042 pounds of express in its 33 planes during the first eleven months of the year, twice the amount carried in 1933.

Reasons for this increase are primarily connected with the mining boom in the northland. Every type of mining and trading post equipment is now flown to and from the northland, including heavy mining machinery.

Other figures of Canadian Airways show that 13,000 passengers and 389,018 pounds of mail were carried during the first eleven months of 1934.

TWO MORE mail runs were added by the Canadian Post Office, the first starting on January 13 from Norway House to Cross Lake in northern Manitoba, and the second to start February 3, from Winnipeg to Berens River on Lake Winnipeg.

THE SEVENTEEN air mail lines operating in Canada during the third quarter of 1934, carried 112,374 pounds of mail; the total air mail for the first nine months amounted to 451,685 pounds, and an increase over the previous year in air mail carried is expected to be shown when complete returns are available.

During the same nine months, Canada's 23 flying clubs had 21,121 members and 78 aircraft; 624 members were under instruction. Private pilot licenses were issued to 65 and commercial licenses to 22, while 8,516 hours were flown.

Aerial photography in northern Ontario, Manitoba and the North West Territories carried out by Royal Canadian Air Force pilots of the Winnipeg station amounted to 620 hours flying time, while air photographic divisions from Ottawa worked as far north as James Bay flying 295 hours. Fire patrol by the R.C.A.F. amounted to 1,600 hours.

At the end of September there were 307 commercial and 37 privately-owned ships licensed; 102 air harbors were officially recognized, while the number of private pilots was 391, commercial pilots 453, and air engineers 448.

THE ROYAL Canadian Air Force recently received 10 new Atlas two-place co-operation planes from Great Britain for replacement of other Air Force equipment. They will be used, principally, at the Trenton, Ontario, R.C.A.F. field.

TORONTO'S WATERFRONT airharbour was used by 616 planes during the summer of 1934, according to Capreol and Austin, who operated the base under lease from the Toronto Harbour Commission.

WORK IS continuing on the airport relief project at the Saint John municipal airport. Among the buildings erected were a new three-plane hangar and a large storehouse. About 150 men are employed at present.

REGULAR AIR mail service has been inaugurated by the Dominion Post Office Department between Rouyn and Kewagama, Quebec.

China

CHINESE AIR services were extended by the opening of two new routes, one each by the China National Aviation Corp., and the Eurasia Aviation Corp. The former is flying between Lanchow and Ninghsia (approximately 250 miles) with one round-trip scheduled each week. The latter maintains a direct service from Canton northward to Peiping, via Changsha, Hankow, Loyang and Taiyuan, (approximately 1,375 miles) with two trips each way made weekly.

Definite plans are under way for the establishment of a Shanghai to Tibet air service, terminating at Lhasa, the Tibetian capital. This is being worked out by China National Aviation as an extension of its Shanghai-Chungking service.

The Eurasia company plans to establish a Shanghai-Berlin service by extending the present Northwestern service, terminating at Lanchow, to Tchukuchak, via Kanchow and Suchow (Kansu), Hami and Urumtchi (Sinkiang) for connection with a Russian service connecting Western Europe. The company is attempting to secure permission to cross the province of Sinkiang.

(Continued on following page)

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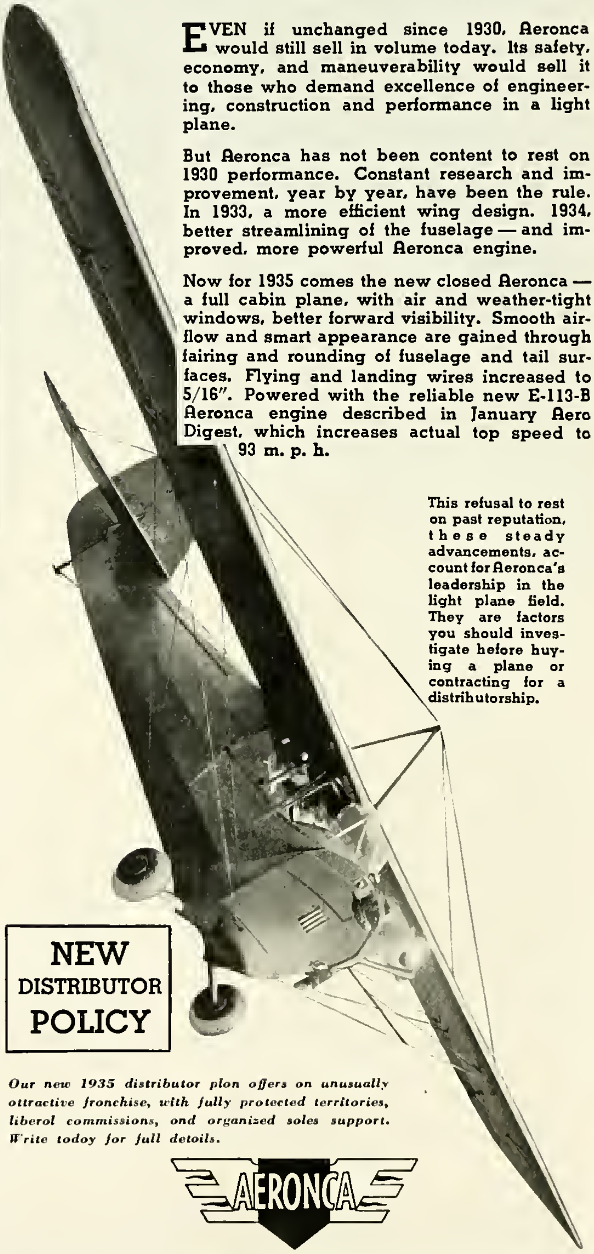

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(*Continued from preceding page*)

France

CIVIL AVIATION has progressed steadily since 1930, according to official sources and the bonuses the government grants purchasers of touring planes is considered to have stimulated sales in France.

In 1930-31, 141 purchasing bonuses, representing $185,249, were granted. In 1931-32, 231 planes were purchased under this system. In 1932-33, 108 planes were bought; and in 1933, 204 planes were purchased. During the period from January 1 to May 31, 1934, purchasing requests received for this subsidy amounted to 192. Of the 800 private planes in France today, 350 are attached to aviation clubs, and 450 are privately owned.

Germany

CAPT. WOLFGANG von Gronau was elected president of the Berlin Air Club succeeding Major von Kahler, who resigned.

AIR TRANSPORTATION shows an increase in figures prepared by the German Official Statistical Bureau covering operations of Deutsche Luft Hansa, Deutsche Verkehrsflug, (a Luft Hansa feeder service) and Deruluft which operates the line between Germany and Russia.

Figures show gains of 15 percent over 1932 in miles flown, 25 percent in passengers carried, and 36 percent in passenger miles; express traffic gained 20 percent and air mail, 22 percent.

Great Britain

REORGANIZATION AFFECTING the position of civil aviation at the Air Ministry has been decided on by Lord Londonderry, the Secretary for Air. The Director of Civil Aviation is to be raised in status to Director-General. Civil flying is to be segregated from the military side, and in the future no question of civil aviation will come before the Air Council. The civil aviation funds vote will be determined by the Secretary for Air personally, on the advice of the Under-Secretary in collaboration with the Director-General of Civil Aviation, Lieut. Col. F. C. Shelmerdine.

IN THE year just closed Royal Air Force planes did more flying than in any previous twelve months since the War, yet the number of serious accidents will show a substantial decline, perhaps even better than in 1921 when the force was about one-third its present size and flew little more than one-tenth of the distance flown last year.

A conservative estimate shows that R.A.F. machines flew about 47,000,000 miles. In 1921 every 2,238 hours' flying was attended by a death; in 1934 the figure rose to approximately 12,000 hours.

The present figure shows that the 93 squadrons of the R.A.F. sustained 19 fatal accidents, involving 28 deaths. Corresponding figures in 1921 were 33 squadrons, 22 fatal accidents, and 37 deaths. That year the Service flew not more than 5,000,000 miles. In 1926, the worst year, 61 squadrons had 54 accidents, involving 85 deaths.

AUTOGIRO TRIALS with the army co-operation squadrons if the Royal Air Force are planned during this summer's training season, designed to test the suitability of the direct control machine in various branches of aircraft work in liaison with ground forces.

Since the first of a batch of six autogiros was delivered by the Avro company to the School of Army Co-operation at Old Sarum, a considerable amount of preliminary instruction has been given. The six machines will remain at Old Sarum till March, when they will be distributed to the army co-operation squadrons.

Italy

FURTHER CONSOLIDATION of Italian transportation companies was evidenced when SISA Air Lines of Trieste was incorporated with Societa Arrea Mediterranea of Rome, with which all Italian civil air lines, except Avio Linee Italiane, and Aereo Espresso Italiana have now been amalgamated.

The consolidating company will continue to operate all services formerly operated by SISA, giving it a total of 17 air services. ALI will continue its four services and AEI will continue its two.

GOVERNMENT PREMIUMS for private aviators up to half the purchase price of small aircraft have been established to encourage Italy's sportsmen fliers, by Premier Mussolini who explained that Italy had need for many more accomplished civil pilots. He explained also the projected stimulation of the production of Italian airplanes and motors.

Japan

ORGANIZATION OF the Pacific Air Service Company had been undertaken in Tokyo with the backing of Japanese and Manchukuoan capital, starting a movement for the establishment of a transpacific Zeppelin service. Three Zeppelins are to be purchased from Germany, and if the plan materializes Zeppelin service will be started between Hsinking and Tokyo, later to be extended to the South Seas, the Hawaiian Islands and the United States.

FURTHER SUBSIDIES for Civil Aviation in Japan are provided in a $34,488,000 program recently announced by the Ministry of Communications. The entire program will not be completed for a number of years, but $5,748,000 will be required for the first stage, and $804,720 of this amount will be budgeted during the next fiscal year. In addition to providing for the extension of air mail services, the plan also provides for training civilian pilots, improvement of flying facilities, and an increase in the number of civil pilots, improvement of flying facilities, and an increase in the number of civil airplanes.

The first stage includes a regular air mail service between Japan and Formosa, with Fukuoka and Taihoku the terminals; a new air mail service between Japan and Korea, with Tokyo or Osaka the Japanese terminal and Ranan the Korean terminal; (radio and weather stations, and landing fields on islands in the Japan Sea will be required); an air mail service between Tokyo and Parao, via the Bonin Islands; air mail service between Tokyo and Sapporo, with stops at Sendai and Aomori; air mail service between Osaka and Kochi, with a stop at Tokushima; and air mail services between Osaka and Matsue, Osaka and Nagano, and between Tokyo and Niigata, on the Japan Sea.

THE JAPANESE government is planning to use an air mail service to tie more firmly to the empire the Caroline and Marshall Islands, held under League of Nations mandate. The Ministry of Communications' budget for this year provides $45,000 for air mail to Pelew in the Carolines, 1900 miles south of Tokyo.

Mexico

UNDER A NEW program of the Ministry of War and Marine, the military aviation corps is to be reorganized and improved so as to provide adequate air defense for cities and states. The plan calls for augmenting the personnel of the two aviation units and acquiring additional combat and scout planes. National aircraft manufacturing is to be encouraged so as to place Mexico in a position to make its own planes and equipment.

Balbuena military airport in Mexico City, the country's largest army airport, has been equipped with a battery of powerful lights and the Ministry has ordered officers of the air forces there to practice night flights. Plans are being considered for the illumination of the leading army airports in the country.

EXPERIENCED AVIATORS are heading both the military and civil aviation departments of the Mexican government. Col. Roberto Fierro, who made a non-stop flight from New York to Mexico City and was commander of the first air regiment, has been appointed chief of the military aviation department of the Ministry of War and Marine, and 1st. Capt. Aviator Jesus M. Romo heads the civil air communications section of the Ministry of Communications and Public Works.

KRUESI RADIO COMPASS

(*Continued from page* 50)

tuning dial by the handle on the remote control box. He tunes in the signals or the program broadcast by the desired station and secures fine tuning adjustment. Then he switches to the bearing indicator. If the pointer is at zero, the airplane is flying toward the broadcast station; if it is to the left of zero, the airplane is heading to the right of the course and he rudders left until the pointer coincides with zero. Conversely, if the pointer is to the left of zero the pilot must rudder right to bring the pointer into position. Drift may be determined by comparing the magnetic compass bearings and the radio compass bearings.

When the pilot wishes to change from one band to another, a turn of the remote control switch automatically makes the necessary switches in the loop and in the receiver unit. In the latest Kruesi radio compass, manual substitution of coils is obviated.

The rotatable loop is used by the co-pilot or the observer in cooperation with the pilot. A hand wheel for turning the loop and a 360° scale are built into the base of the loop mechanism. The co-pilot tunes in on any two stations and secures a zero bearing on each. By means of the scale, each indicated bearing can be quickly read and lines drawn on a map with reference to the magnetic compass course. The intersection of the lines indicates the airplane's position.

AIR TERMINAL PROFIT

(*Continued from page* 28)

The Curtiss-Wright Technical Institute of Aeronautics is a specialized institution giving in one year a course that would require four years in college or universities wherein studies other than aviation are required. Its training meets the strict demands of the industry and its courses are being constantly improved to keep pace with the development of aviation. Its students are in personal contact with every phase of the industry and so receive first-hand information of what the industry demands of its employees. In addition to its regular curriculum, the school offers a practical home study course in aeronautical drafting. Two courses are available at any time and the school operates with the approval of the state boards of education of California, Oregon and Washington. Its credits are acceptable in numerous political subdivisions and institutions of learning and it grants college credits. It is also approved to train non-quota foreign students.

The aviation engineering course requires 2000 hours, of which not less than 400 hours are required in practical shop work. With the eight-hour day and the five-day week, the student in engineering devotes about one year to the course.

The master mechanic course calls for 1600 hours or about ten months.

The Grand Central Flying School has a complete group of instructors and airplanes. Its courses in civil aeronautics are arranged to meet the desires of the beginner as well as the transport pilot who wants the most approved form of instrument flying instruction.

Even the United States Government is much in evidence for the convenience of all airlines operating between Glendale and foreign points. There are Customs collectors, Quarantine doctors, Immigration Bureau men and Agriculture inspectors.

RECOMMENDATIONS

(*Continued from page* 36)

cial assistance by the government. . . ."

"We have heard much testimony and collected many figures on the amount of governmental aid that is necessary to keep an air transport service running under present conditions and on the ways in which the aid should be administered, but we have made no attempt to develop a detailed formula. We do arrive at certain general conclusions, the first and most important of which is that this is a matter to be left fully within the jurisdiction of a non-partisan commission, remote from any regional or factional interest. We conclude that it is possible to develop formulas for determining the amount of aid needed, capable, with minor variations, of broad application on a countrywide scale. We believe that the development and use of such approximately standardized methods of determining the amount of aid that should be given in any instance is likely to produce in the long run a better service at less cost to the government, and to afford a greater stimulus to managerial economy and alertness to improve the service, than is the alternative method of treating each line as a separate case and so fixing the compensation of each one as to return some standard percentage of profit. . . ."

"We have not delved deeply enough into all of the figures involved to wish to make any final expression either on the precise formula which should be used in allocating aid or on the precise sums involved. We offer it as our impression, however, that the amount of aid paid per mile flown should not have to exceed about 25 cents per mile on any route and that the total allotment for direct aid to keep the present domestic air transport services functioning on their present scale should be about $7,000,000 a year, or an average of about 16 cents per total mile now being flown. . . . "

The Commission discussed rates of pay for the transportation of air mail, recommending that the payments should be fixed by the proposed Aviation Commission. After suggesting that the airlines be paid at a fixed rate per pound mile, the Commission further suggested that that rate should be determined and from time to time adjusted by the proposed commission exactly as the rates for carrying mail by rail are prescribed by the Interstate Commerce Commission. It continued its discussion of the subject by saying that " . . . To avoid . . . complications we recommend, at least for the present, an adoption of the uniform-flat-payment-per-pound-mile system, and we suggest that any undue profit from the handling of mail at a flat rate on routes of very heavy mail traffic can be obviated by commission orders to increase the number of schedules on such a route and to improve passenger service.

" . . . The determination of a unit rate of payment properly geared to postal revenues would of course be based upon information received from the Post Office Department, but the actual fixing of the figures should in our opinion be a commission function. We have formed no definite idea as to the precise level at which the rate might reasonably be fixed. Estimates of the present revenues to the Post Office Department per pound-mile of air mail service performed range from 1 mill to 2 mills, with the probability that the former is nearer to the true figures than the latter. Among the first responsibilities of a new aviation commission, if one should be created, should be a co-operation with the Post Office Department to make a specific determination of the true value. . . ."

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WRITE FOR NEW CATALOG

GETTING LOST

(*Continued from page 27*)

of hardy woodsmen to retrieve him and his passengers, after they have spent three days and nights learning how a cold storage egg really feels about it all.

Now, it is obvious that the survivors among the modern railroad track pilots will in time become just as experienced in bad weather flying as the older group of instrument pilots; given a little luck they will learn, by the uncertain method of trial and error what their older brethren also learned by trial and error. But such a course leaves to chance what could be accomplished more safely and with a greater degree of certainty.

My concrete suggestion is that on every airline one or more pilots who have proved through the years that they really are experienced instrument flyers should be employed as instructors on the line itself, not merely around the airport; that in tough weather they should make regularly scheduled trips with all of the line's pilots in turn, to instruct them, to help them, and to check up on their ability or lack of ability in a kind of flying in which not all of the airline pilots are as yet really proficient. And it is useless to argue that all are proficient and do not need this form of instruction when one of them leaves Newark, bound for Buffalo, gets lost, wanders around, and finally lands at Lowell, Mass.; while another cannot find Newark airport, cannot find any other airport, cannot return on his course into clear weather, and so lands on a marsh in Staten Island; while yet another keeps on going in weather that was too bad for him, gets off his course, cannot return to the airport he had left a short time before, and finally, after wandering in circles for hours, ends up with a crash. Nor does it solve the problem, nor is it even fair, to blame the pilot for his error due to lack of instruction, and fire him.

Under the present system, which gives an airline pilot an SAT rating when, among numerous other things, he proves his ability to fly around an airport on instruments under a hood, sometimes more is expected of him than his tests and his experience warrant; and this applies not only to the younger men but also to veterans of the lines who never really did instrument flying until the SAT rating requirement forced them to stick their heads under a hood and keep their eyes on the ball. Thus the pilot is left hold-

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You get practical overhaul and repair problems ing the bag when he gets into difficulties and an accident occurs; and he may count himself fortunate if the line does not fire him—for fear that such action might be construed as an admission that its employee was not capable, and thus lead to damage suits by passengers or their heirs. And right here let me say, for the benefit of those pilots who may labor under the mistaken impression that I am merely indulging in carping criticism of their profession, that what I am demanding is a fair deal for pilots: and under the present rating, the present inconclusive tests, and the present lack of instrument flying instruction on some lines, all of the pilots are not getting a fair deal to-day.

There are more things to learn than keeping an airplane level and straight and making it do proper turns while the pilot is sitting in a hooded cockpit; there is the important matter of radio, and knowing how to get back on a radio beam if the ship has drifted off it, or has been flown off it, and knowing when to stop looking for what perhaps cannot be found, and to fly on by compass—which still points to the North, even in static! And there is the matter of knowing, by proper analysis of all information, whether to go ahead, turn back, or get lost, fly in circles, and hit a tree. While it is true that only experience can teach a pilot all of these things, competent instruction will go a long way toward minimizing the dangers and assuring a greater measure of safety in airline operation with fewer accidents, fewer damage suits, and lower insurance rates.

The worst effect of the SAT rating, based on under-the-hood training without the necessary supplementary training in bad weather conditions, is that it tends to give a pilot over-confidence that eventually may lead him into difficulties that he cannot surmount. Flying into bad weather he may take out his license, glance at it, and hum reassuringly, "I'm a bad-weather pilot—this I know—Eugene Vidal tells me so." And is his face red when suddenly he finds himself landing inside the Pearly Gates and meets an angelic Quartermaster Sergeant who hands him a harp and remarks, "Go over there and get in tune with the late General Grant."

PERSONAIRLITIES

(Carried over from page 61—and how!)

early test pilots, he had little test work and much spare time, so he got all the odd jobs that other fellows were too busy or too smart to do. By September the hay was all in, and so was William, so the Mercury Co. turned him out to graze for the winter—not an uncommon occurrence in those days, for in 1926 the aircraft industry was enjoying a quiet depression of its own.

Shaking the dust of unappreciative Hammondsport from his sandals, William girded up his loins and journeyed unto the land of Pratt & Whitney, and lo and behold that same month of October, 1926, found him assembling Wasps and Hornets, doing torque stand tests, field service, and finally blossoming out in all the dignity of Chief Test Pilot. When a Wasp swallowed a valve, he landed the Boeing 40 on a stump, and was immediately informed that the management wanted him to go to Japan for them. Bill never learned whether this was a promotion, or merely a cautious move to conserve the company's airplanes, for he resigned, in May, 1928, to fly for Colonial Western Airways, as mail pilot on the Cleveland-Buffalo-Albany route. He flew the mail for nine months and then joined Consolidated Aircraft Corp'n as Chief Test Pilot. He has been with Consolidated since January, 1929, and has tested a variety of planes, including the Fleet, Fleetster, Navy Patrol Boats, Navy Dive Bomber, Army Attack and Pursuit, and inverted-flight Fleets for Europe.

Bill should be very happy in his job, for he's working with Major Rube Fleet, president of Consolidated, a grand fellow who always reminds me of Chic Sale, and with Lawrence D. Bell, General Manager, known locally as The Working Man's Friend. It was Larry Bell who foisted me on American aviation back in 1922 when I returned from Canada, dressed in a moose-hide, that I'd shot myself in Winnipeg, and with my squaw trudging along behind carrying the traps, and a bag of flour. Mr. Bell was General Manager of Glenn L. Martin's factory in Cleveland at the time and he said that he needed a test pilot for the Martin Night Mail plane, then nearing completion. Did I know anything about testing? "If it has wings," I replied casually, "I can fly it." There's no use being modest when you're trying to grab yourself a job. "You don't seem to have any doubts about yourself," he remarked. "If I had no confidence in myself," I replied, "how could I expect anyone else to have confidence in me?" That seemed to impress him, and I got the job.

Last summer I visited Consolidated and was talking over old times with Mr. Bell and Bill Wheatley. I mentioned that testing an airplane in 1922 was child's play compared to the gruelling tests that the Army and Navy demand today of the contractors, such as diving a plane up to 9 G's, a most harrowing and sometimes mortifying experience for the thoughtful test pilot. "In the good old days," I remarked, "we made it a point to find out as little about the ship as possible, to leave in all the bugs we could, and to get rid of the thing and collect our money with the least fiddling about—that used to be the system." Mr. Bell grinned. "It still is," he said.

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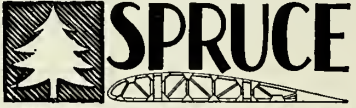

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WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To: Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Two-Place Pursuit Airplanes, together with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935; no communications received after 2:00 P.M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 788). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To: Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Observation Airplanes, with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than April 25, 1935; no communications received after 2:00 P.M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 788). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

WAR DEPARTMENT Air Corps, Materiel Division, Office of Contracting Officer, Wright Field, Dayton, Ohio, January 5, 1935. To: Airplane Designers and Manufacturers. 1. The War Department invites the submission in competition by sealed communications of new designs covering Bombardment Airplanes, together with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935; no communication received after 2:00 P. M., Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926, 44 Stat. 788. The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. PARK HOLLAND, 1st Lieut., Air Corps, Contracting Officer.

WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To: Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Single-Place Pursuit Airplanes, with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935; no communications received after 2:00 P.M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 788). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

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OFFERED: Wasp B engine; 130 hours guaranteed total time. Complete with starter and propeller. Make offer. In New York. AERO DIGEST, Box 1977.

WACO 10: Always privately owned and flown; must be seen to be appreciated. Only $385 flyaway. Terms, $200 down, balance monthly. Pioneer Aviation Co., Airport, Syracuse, N. Y.

PITCAIRN AUTOGIRO: 300 h.p. Wright engine, 3-passenger. Flown 800 hours. Any reasonable offer takes ship complete or will sell engine, rotor blades, other parts separately. AERO DIGEST, Box 1970.

DRIGGS: Rover-powered. Engine just majored, ship refinished, many extras. $800. Aeronca C-3, engine overhauled, excellent condition, $750. Air Activities Airport, West Chicago, Illinois.

WACO CABIN: Late 1934 model, Jacobs motor, electric starter and generator. RCA radio, bank and turn, landing lights, flares. Top speed, 150 m.p.h. Never cracked. Absolutely like brand new. Must sell immediately. Wire or write The H. C. Rohhins Company, Cleveland Airport, Cleveland, Ohio.

FOR SALE: Four Wacos. 1932 cabin, 210 Continental, deluxe equipment, radio, ambulance, leather upholstering, 425 hours; $3,250. 1932 Model A, 210 Continental, deluxe equipment, winter enclosure, 360 hours, major overhaul, $2,750. Two F's, Kinner 125 h.p., excellent condition; $1,250 and $1,750. Muncie Aviation Corporation, Muncie, Indiana.

AERONCA C-3: Oleo landing gear, enclosure, bank indicator. Excellent condition, licensed till April 15, 1935. Ed Fifer, 117 Riverside Drive, Elkhart, Indiana.

FOR SALE: Like new Fairchild "24." Bank and turn, rate of climb, brackets for flares. Wired for landing lights. Ship would cost $5,225 as equipped, at factory. Make big saving. Max Marshall, 407 H. O. B., Washington, D. C.

BARGAIN PLANES FOR SALE: B-5 Kinner Bird, 3-place, starter, special instruments, lights, etc. Fairchild 22 with very little time. J6-7 Waco straight wing in excellent condition. Also have J6-5 Travel Air and P-2 Privateer. Airport, Natick, Massachusetts.

SALE: AERONCA 2-place E-113 Collegiate. Navigation lights; oleo landing gear; licensed September, 1935. Excellent condition. Price, $700. Dr. Raymond Fisher, 208 Olympia Bldg., Miami, Florida.

LATE OX WACO: Airwheels, Scintilla mag, Miller rocker arms, Pioneer instruments, oil temperature; snappy yellow and green paint job. Both cockpits upholstered. Just relicensed. $525. Earl E. Bach, Philadelphia Muncipal Airport, Philadelphia, Pennsylvania.

FOR SALE: Gipsy Moth, perfect, $700. Warner Cessna, excellent, will positively accept best offer. OX Robin, licensed, $400. Kinner Wallace Touroplane, 3-place cabin, $975. John D. Jacoh, Malvern, Pennsylvania.

FOR SALE: Bird; Kinner K-5. Front exhaust; collector ring. 30 hours since major. Semi-air wheels, duals, licensed. No reasonable offer refused. Clyde Miller, Staatsburg, New York.

WACO STRAIGHT WING: J6-5. Covering A-1. $1,100; might consider small licensed fast plane in trade. J. W. Lytle, 2333 Vodeli St., Pittsburgh, Pennsylvania.

TAYLOR CUB: Continental A-40-A, new. Winter enclosure. Best offer above $1,000. Mutual Flying Service, Romulus, Michigan.

FOR SALE: New Salmson AD-9 motor, never used, complete with hub, tools and crate. $300. H. G. Squires, 4419 Richmond Road, South Euclid, Ohio.

FOR SALE: $475. 3-place OX-5 Swallow, just recovered, relicensed; steel propeller, Bendix wheels; will trade for car or cheaper ship. John Ruzicka, Hoxie, Kansas.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

PLANES AND ENGINES FOR SALE

AMERICAN EAGLE: Kinner 3-place in fine condition. Just overhauled. Paint and covering first class. Licensed. $695. No less; no brokerage. P. O. Box 1093, Miami, Florida.

ARROW SPORT: LeBlond; excellent condition. 230 hours total time; 20 hours since complete overhaul. Equipped with Hamilton Steel propeller. $750. Consider trade on Lambert Monocoupe or Warner Davis. Ralph Herring, 1712 Sixteenth St., N. W., Washington, D. C.

FORD TRIMOTORS: 3 J-6's, $4,500; Wasp job, $7,500. Fokker trimotor: 3 Wasps, $3,000. Travel Air cabins: 6-place (like new) Wasp "C," $3,000; J-6 330 h.p. job, $2,350. Great Lakes: Warner, $675. Many other values! Engines, guaranteed majored: Hornet A-1's, $600 to $750. Wasp C-1's, $900 to $1,100. Wasp "B," $650 to $750. Kinner K-5, $300. Comet E, 165 h.p., $200. Warner 125 h.p., Number 844, $475. Wright J6-7, "D," $800. Wright J-5, $500. Wright Gipsy (new), $375. Lycoming R-680's, $500 to $650. Charles Babb, Grand Central Air Terminal, Glendale, California.

AERONCA C-3: 100 hours total time. Six months old. Perfect condition. Will sell or trade for good three-place job. Prefer Waco F or Kinner Bird. W. W. Clark, Portsmouth, Ohio.

MUST SELL: Fairchild 71; Loening Commuter; Bellanca Skyrocket; 4 Wasp engines complete; props, magnetos, very cheap. Fairchild 71; floats. Aircraft Salvage Co., Flushing Airport, Flushing, New York.

AERO BARGAINS: A used aircraft directory listing flyaways, crack-ups, motors and equipment. Send 15c (preferably in coin) for your copy to Aero Bargains, Greenville, Ohio.

STINSON LYCOMING: 410 hours total time; completely recovered, finished in Stinson Green and Diana Cream. High gloss finish. New control cables, engine completely overhauled. No time since overhaul. Price $2,250. C. W. Hutchinson, 2530 Ridgeland Pl., Cincinnati, Ohio.

WACO CABIN: Powered with 210 Continental; 250 hours total time; always hangared, never cracked; privately owned. Landing lights, Lear radio, bank and turn. Bloomsburg Flying Club, Bloomsburg, Pennsylvania.

BARGAIN: English Gipsy Moth, steel fuselage. Only 60 hours since complete overhaul engine, plane. Licensed. Best materials used. One Irving silk parachute, perfect condition. Many extra Gipsy, Moth and other parts. Extra airwheel tire. Quick sale, everything $700. Apartment 7, 63 No. Walnut St., East Orange, N. J.

KINNER, OX-5 BIRDS: Perfect. Stinson SM1B, J-5 powered. J-5 motor, starter, $300. J-5 Kinner, Travel Air, Bird, Waco F parts, cheap. Irvin parachutes, $60. Irving Swedler, 816 Ontario St., Toledo, Ohio.

LICENSED EAGLEROCH: OX-5 Millerized motor, American propeller; recovered 1932; airspeed, compass, duals, $325 flyaway. Terms, $150 down, balance monthly. Pioneer Aviation Co., Airport, Syracuse, New York.

NEW FAIRCHILD 24: We will take your ship in trade. Give complete description of your ship first letter and we will send you estimate of trade-in value. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WARNER-POWERED WACO A: Finished and equipped for display. Flown only 200 hours. $1,850. Stearman C-3-R with J-6-7. Perfect condition. Many extras and instruments. $1,500. Continental-powered Taylor Cub; new ship condition. $950. Fledgling with Challenger. Best Fledgling in Ohio. $825. Complete information on request. Meinke-Eldred Flying Service, Willoughby, Ohio.

WARNER WACO F: Ryan Speedster; Hisso Eaglerock; Ryan B-3; Heywood starter for J-5; Waco wings and parts. Repairs and rebuilding at lowest prices. Charley Raudabaugh, 13210 French Road, Detroit, Michigan.

SPEEDWING LAIRD: Wasp 420, cruises 150—tops 185. Less than 400 hours total. $3,000 cash or will trade for late Stinson or Waco cabin. R. F. Hoey, Hangar 3, Floyd Bennett Field, Brooklyn, N. Y. Phone: NIghtingale 4-4200.

FOR SALE OR TRADE: Reconditioned Continental Wallace Touroplane; J6-7 Stearman, J-5 Travel Air; J6-7 Cessna; Waco F; OX-5 Waco; Taylor Cub; Curtiss Challenger; Great Lakes; Taylor Chummy, new, less engine. Write for details. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

1932 WACO CABIN: 210 Continental; equipment includes turn-bank, rate climb, flares, landing lights, pants; 70 gal. tanks; fine condition; privately owned. Ray Hetzel, 1512 Main Street, Buffalo, New York.

ROBIN: Challenger engine, overhauled; excellent condition; shielded for radio; standard instruments; sell or trade, $900. J. Warren, 316 Rutland Road, Brooklyn, New York.

MUST SELL: No reasonable offer refused. Will trade; terms to responsible parties. Waco cabin 1934, Jacobs; total time, 315 hours; now completing engine top overhaul and plane check, consequently perfect condition. Deluxe equipped with full blind and night flying equipment, clock, radio, special paint. Also OX Waco, good condition, licensed, $325. Waco Sales of New England, Inc., Dennison Airport, North Quincy, Boston, Mass. Granite 1618-R.

LYCOMING STINSON SM8A: Just recovered; orange and black. Oversized semi-air wheels; speed ring; complete night blind flying equipment; retractable landing lights; Wiley flares. $1,800. Lou Hensler, Princess Theater, Toledo, O.

CURTISS THRUSH: 6-place, modernized J-6 engine, just overhauled; night flying equipment, speed ring; striking paint job. $1,975. Garth Norman, 1508—23rd St., Parkersburg, W. Va.

J6-7 TRAVEL AIR: 3-place Sport; 22 hours since complete major overhaul; air wheels, tail wheel, brakes, starter; excellent condition. Licensed till September. $1,650. Ernest O'Neill, 116-15 114th Avenue, Ozone Park, New York.

J-5 STINSON: $500 cash; no trades. Six-place SM1B cabin monoplane. Identified. Needs only recovering for relicense. Engine time, 120 air, 175 total. Ship time, 300. Providence Airport, Seekonk, Massachusetts.

FOR SALE: OX-5 Robin, $400. D. H. Moth, $700. NB-3 Barling wings and parts; LeBlond 65 motor and prop. A. J. Hartman, Burlington, Iowa.

AMERICAN EAGLE: OXX-6 with two Scintilla magnetos, dual airspeed; plane has been recovered; licensed to October 1935. $395 flyaway. Terms, $200 down. Pioneer Aviation, Airport, Syracuse, New York.

BUHL PUP: Just majored, repainted, perfect condition; will sacrifice for immediate cash; reason: want larger ship. K. Gault, 4407 Maine Avenue, Baltimore, Maryland.

KEYSTONE-LOENING Commuter: In A-1 condition (40 hours since new). "D" type J6-300 with 17 hours since major overhaul; full set Pioneer instruments; NC licensed. For further information or inspection: Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pa.

FOR SALE: Waco "C," Wasp Laird, Fairchild 22, Fairchild 24, Lambert Monocoupe, Warner Monocoupe, Stinson Jr., Stinson Reliant, Lockheed Vega, Wasp Bellanca, Waco F-2, Aristocrat. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

WACO F-2: Continental 165. 240 hours total, 75 since major. Instruments, brakes both cockpits. Always privately owned, excellently cared for. $1,875. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

MONOCOUPE: Warner 125 h.p., only 260 total hours, 50 hours since complete overhaul. Never cracked up, always privately owned. Equipped with ring and racing landing gear, heater for winter. Truly excellent condition throughout. Price, $2,100. Located Hangar 3, Floyd Bennett Field. No agents. AERO DIGEST, Box 1979.

FOR SALE: One Eaglerock airplane with OX-5 motor with major overhaul and in perfect condition. Information: Herminia Reyes, 1333 Fifth Avenue (Apartment 4N), New York, N. Y.

FOR SALE: Curtiss Robin, Wright J6-5, factory modernized. Total time 251, 75 since overhaul and modernization. Equipment: Bank and turn, electric starter and generator, cabin heater, navigation lights and metal propeller. Appearance good, condition excellent. Price, $1,500. Baltimore Flying Service, Inc., Curtiss-Wright Airport, Baltimore, Maryland.

THREE AIR-COOLED SHIPS: All excellent ships, priced to sell. Travel Air Sport, with 125 Kinner, every extra. J-5 Eaglerock, extras, just relicensed. Bull Pup, 45 h.p. Szekely, steel barrels. All ships licensed. Consider trades on autos and airplanes. Dick Schall, Berwyn, Md.

DELUXE FLEET: Sport Trainer; Kinner B-5; steel prop; Airwheels; positively looks new. Only $1,750. Texas Fairchild Sales Corp., Houston, Texas.

PARKS OX: Completely rebuilt, just relicensed. Will sell or trade. Terms to responsible parties. Jim Kukla, Western Hills Airport, Cincinnati, Ohio.

FAIRCHILD 24: 125 h.p. Warner, 185 hours, $2,500. Cessna J6-7: A-1 condition, no reasonable offer refused. OX-5 Challenger: 30 hours since major. All ships licensed. Princeton Airport, Rocky Hill, New Jersey.

CURTISS-WRIGHT JUNIOR: $450. Curtiss-Wright Junior, $325. D.H. Gipsy Moth, $850. All licensed and ready to fly away. D.H. Gipsy motor and Moth plane parts cheap. Waco 10 fuselage, upper wings and tail surfaces, all uncovered. Two overhauled OX-5 motors and parts. Any reasonable offer for the lot will be considered, or will sell separately. Used Wright Gipsy motor parts. Fort Smith Airways, Fort Smith, Arkansas.

BARGAIN FOR CASH: Kinner low wing, side by side sportster, like new, $1,250. N. C. Nov., '35. Air starter, brakes, airwheels, 180 hours, best care, always hangared. N. Patterson, Niagara Falls Airport, New York.

SALE OR TRADE: Savoia 3-place Amphibion; starter, air wheels, licensed; little time, fresh water. One right wing for Aeronca C-3. Glenn T. Clark, 721 Sixth Street, Charleston, W. Va.

FOR SALE OR EXCHANGE: 11 certified airplanes, as follows: J-6 B-5 Ryan cabin ship, air wheels; LeBlond-powered 2-place Davis monoplane; J-6 6-place Stinson cabin ship, air wheels; J-5 B-1 Ryan cabin ship; 2 OX-5 Waco 90's; 2 J-5 Straight Wing Wacos; J-4 Waco; 165 h.p. Continental Verville training ship; J-6 250 h.p. Straight Wing Waco. All ships NC licensed and ready for delivery. Good late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

WACO CABIN: 165 Continental; motor, ship perfect condition; 300 hours. Bank and turn. Cash, $1,750 or trade Waco "A". Armin Richard, Box 33, Lafayette, Indiana.

STINSON: Model S; black and silver; leather upholstering; just relicensed; motor modernized and ship in perfect condition throughout. $1,650. Evans Operations, Inc., 232 Peachtree, Atlanta, Georgia.

10C KINNER MONOCOUPE: Excellent condition. Ship 335 hours; motor 80 hours since major. Don't send for description unless you have $750 cash. W. F. Kaltenbach, 316 N. Butler Blvd., Lansing, Michigan.

FOR SALE OR TRADE: Late 1933 Waco Cabin. Many extras. Ship and engine brand new condition; will consider smaller type ship or car in trade. Inquiries invited. Dr. George F. Lindig, 745 Fifth Ave., New York, N. Y.

TRAVEL AIR SPEEDWING: Sale or trade. Wright J6-7. No time since major. Specially stream-lined; very fast; extra gas; excellent condition; just relicensed. M. M. Osterberg, 410 East 7th Street, New York, N. Y.

BEECHCRAFT: For sale or trade. Jacobs motor, 40 hours; ship equal to new. Special paint, upholstering, instruments; excellent condition. AERO DIGEST, Box 1980.

COMMAND-AIRE OX-5: For sale. Also spare OX-5 parts. Ship needs repairs. Located New York territory. No reasonable offer refused. AERO DIGEST, Box 1981.

AIRPLANES FOR SALE: J-5 Bellanca: 6-place, $1,750. Kinner K-5 100 h.p. Lincoln PT, two-place, engine overhauled and ship recovered; complete with radio, flares and blind flying equipment, $1,245. Two Wright Gipsy Travel Airs, $1,225 and $1,275. J-5 Laird, $1,475. Stinson Reliant, $3,985. Two J-5 Stinsons, $1,150 and $1,650. Stinson Model S, $1,895. Model R Stinson with radio, $2,985. Write for details. Chicago Aviation Corp., Curtiss-Reynolds Airport, Glenview, Illinois.

FORCED TO SELL: Waco Model A, two-place with side-by-side seating. Warner motor. Demountable winter top. Many other extras. Never cracked. Wonderful condition. Wire or write the H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

FOR SALE OR TRADE: Curtiss-Wright Sedan, Wright J6-7, 4-place cabin; very little time; many extras. Interested small ship, standard make, for personal instruction, or priced reasonably for cash. E. Adams, 160 Park Avenue, Freeport, New York.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

MISCELLANEOUS PRODUCTS, ETC.

FOR SALE: Two used 9-cylinder Heywood air starters in excellent condition, at bargain prices. John Cregier, Box 76, Chappaqua, New York.

GRIND SEATS: Don't waste time spoiling cutters on glass-hard valve seats. Our carborundum wheels grind them quickly, more accurately. ¼ inch electric drill only tool needed. Complete with pilot, $3.50. State engine, intake or exhaust. Air Transport, Garden City, New York.

WAR RELICS for clubhouse or den. Vickers aircraft machine guns; cost government $700; rendered unserviceable without marring. Only $7.75 each. Sent COD on payment of $1. Weight 33 pounds. Fiala Outfits, 47 Warren Street, New York, N. Y.

BROTHER, CAN YOU SPARE A DIME? If you can, send it to me and I'll send you my 1934 Low-priced Aviation Material Catalog. Karl Ort, 620 W. Poplar, York, Pennsylvania.

TIRES: We have big assortment at liberal discounts. We also have new 650 x 10 variety semi-air wheels, tires, tubes, brakes complete, $80. New 6-ply 950 x 12 tires, tubes, wheels, less brakes, $80. Sun Aero Motors, 10529 Gratiot Ave., Detroit, Michigan.

WRIGHT 240 crankcase, crankshaft, rear case complete with clutch, cylinders, other parts. 500 lbs. 9/32 aircraft clevis pins. Standard steel Kinner blades, new, Design 1833. Frank Mills, Essington, Pennsylvania.

FOR SALE: Right upper and lower Travel Air 3000 wings, center section gas tank, Bendix wheels, tires and brakes; Travel Air landing gear; Hamilton steel propeller just reconditioned, rear half Travel Air fuselage; bank and turn and airspeed instruments, struts and wires, other miscellaneous Travel Air parts. Make offer. Aircraft Owners Association, 901 Continental Bank Building, Indianapolis, Indiana.

LIMITED QUANTITY unused Kinner K-5 engine parts at 60% of list prices. Wire or write Fleet Aircraft, Inc., Buffalo, New York.

TWO J6-5 WRIGHT engines: Overhauled completely by authorized Wright station and modernized with clutches; no time since overhaul; $500 each. Will accept your engine as part payment. One J-5, as is, $325. Twelve J-6 cylinders, reconditioned ready to install, $25 each; one J6-5 carburetor, overhauled, $45; 2 J6-5—2 J6-9 magnetos, overhauled, $25 each; one J6-5 main case, good condition, $60; one J6-5 crankshaft, master and art rod assembly, reconditioned, $100; one Kinner K-5 main case, reconditioned, $40; three Kinner (Scintilla) magnetos, overhauled, $15 each; one Kinner or Warner carburetor (Stromberg), overhauled, $25. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

AUTOGIRO ROTOR bargain: Matched set of four rotors, like new, for three-place open Pitcairn Autogiro with J-6 330 engine. Make offer. AERO DIGEST, Box 1968.

FOR SALE: Barling NB-4 fuselage complete with controls, oleos, tail group, gas tank, motor mount. Write A. H. Stier, 526 So. Ashland Ave., Detroit, Michigan. Everything will pass Department.

SELL OR TRADE: One Challenger motor, new; one used; propeller, speed ring and motor mount, 4000 Travel Air. Want J-5 motor, propeller and mount for Travel Air 4000. Box 183, Natchitoches, Louisiana.

ENGINE AND AIRPLANE PARTS: Challenger, J-5, Velie, Warner, Szekely, OX-5, Lakes, Waco 10, Travel Air; Hubs, Challenger and J-5. Dunaway Garage, 2201 Indiana Ave., Kansas City, Missouri.

SZEKELY MOTORS: New in crates; also genuine Szekely parts (these are not machined) at 50% off. Sun Aero Motors, 10529 Gratiot Avenue, Detroit, Michigan.

FOR SALE: J-5 engine with five hours since true major overhaul, $475. J-5 speed ring, excellent condition, $35. Majored J-4 engine, $225. Also J-5 parts, cheap. Mackey Flying Service, Findlay, Ohio.

LAMBERT MOTOR: Just overhauled; total time 350 hours since new; complete with Hamilton steel prop. J-5 Standard cylinders, 370 hours total time. Velie motor, in good shape. Two practically new Inverted Cirrus motors, complete with Hamilton racing steel prop. Sun Aero Motors, 10529 Gratiot Avenue, Detroit, Michigan.

PROPELLERS: Lowest prices in the country. Steel props for J-6, J-5. A few brand new Hamilton wood props at $15. We stock Flottorp, Marshall and Bennett propellers for all motors. Central Air Service, Grand Rapids, Michigan.

FOR SALE: Numerous plane and engine parts for Challenger C-2, OX-5; two OX-5 motors; also parts for Wasp motor. James Fungaroli, Jr., Bedford Airport, Bedford, Pennsylvania.

WINGS, SPARS, ETC.: Large stock replacement wings ready to ship. Laminated, routed and plain spars. Shipped promptly on order. Also ribs. Send for list of our used parts. Chicago Aviation Corp., Curtiss-Reynolds Airport, Glenview, Illinois.

ENGINE, AIRPLANE SURPLUS PARTS: For Waco, Bird, Travel Air, Fleet; Warner, Continental, Wright motor parts. Write or wire us your needs. Waco Sales of New York, Inc., Hangar 16, Roosevelt Field, Mineola, New York.

NEW AND USED PARTS for Stearman, Fleet, Waco 9, Lockheed Vega, Fokker F-10, Ryan B-1, Wasp, Wright J-5 and J-6, Warner and Szekely. All types instruments, tires, wheels. Write for lists. Hanford Airlines, Inc., Airport, Minneapolis, Minnesota.

IF IT FLIES WE HAVE IT: 250 weather-proof Navy flying suits with zippers, front and legs (cost $20) now $3.75. 10 x 3, 500 x 3, 500 x 4, 14 x 3 tires, tubes and wheels, $7.50 each. 24 x 4, 26 x 5, 26 x 3, 28 x 4 straight side non-skid tires, $3.50 each, larger sizes, $5 each. Wire wheels from $1 to $3 each. Standard steel propellers: Velie, Kinner, Wasp and Hornet, $75 to $150. Parts for Wright Cyclone R-1820-F. New 1750 Cyclone, new Wasp and Hornet motors, and parts for all makes of motors. Generators, starters, valves, exceptionally low prices. Liberty, Hall-Scott, Mercedes, Hisso's, Lawrance, Cirrus and other makes of motors, $50 to $150 each. Siemens-Halske new radial motors in original crates, 70 h.p., $250 each. Practically new L-head Aeronca motor, $140. Motor generators, 10 volt input, 300 volt output, $10 each, cost $100. New Fahrenheit temperature gauges, 12-foot tubes, $1.90 each. 3½ inch dial, 20,000 foot new altimeters, $3. 18-gauge sheet dural, 35c per pound. B. G. 4-B spark plugs, 50c each. AC, Champion, Splitdorf, 25c each. Turnbuckles, shackles, clevis pins, cloth, dope, nickel steel bolts, exceptionally low prices. 10 x 3, 14 x 3, 20 x 4 drop center wheels, $3.50 each. Bank and turn indicators, $35. Rate of climb, $40. Aerial mapping cameras, $100. Silk Irvin parachute with pack, $100. Small silk flare parachute, $2.50. Instruments of all kinds. Gunners' safety belts, 50c each. Standard steel blades, $35. B-2 and B-3 engine throttles, $2 and $3.50 each. Engine primers, choke controls, $1 each. Parker and other fittings, 70% off. Four, six, nine, twelve cylinder Scintilla magnetos, $25 each. See us for bargains. Crawford Airplane Supply Company, Venice, California.

B-5 OWNERS: Reinforce your cylinder heads before they crack too far. Our truss eliminates this trouble. $15, installed. 24-hour service. Process, equipment and tools sold to service stations. Attractive proposition. Air Transport Equipment, Garden City, New York.

COMPLETE INVENTORY Wasp parts: 50% list. New books on aviation; cost $8; now 60c each. Aircraft Salvage Co., Flushing Airport, Flushing, L. I., N. Y.

BRAND NEW pair 22x10-4 Goodyear hubs, $20. Cirrus heads in A-1 shape, complete with valves, valve springs and rocker arm assemblies, $20. New Pioneer bank and turn, rate of climb combination with Venturi tube and vacuum bottle, $75. NAR-3 carburetors, $15. Pair good used mud guards (fenders) with mounting brackets for 8.50x10 tires, $25. MN7D, MN7DF, VAG9D Scintilla magnetos, $15. Brand new 8-foot mahogany propellers, $5. New NACA cowling (with brackets) for Jacobs, $25. J-5 and J6-9 exhaust collector rings, $15. 24-foot Switlik pongee seat parachute in excellent condition, $75. Complete stock of brand new factory parts for Pitcairn PA-6 and PA-7 Mailwings. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pa.

K-5 KINNER PARTS: Front exhaust heads, complete stock, lowest prices; slightly used. Or will buy ship without engine taking Kinner. Dick Schall, Berwyn, Maryland.

FOR SALE: Lear Radio, Lycoming motor, 650-10 pants, Fairchild parts, J6-300 motor; cracked-up Laird. Aircraft Sales Company, Hangar D, Roosevelt Field, Mineola, New York.

COMPLETE PITCAIRN: Wright 300 Autogiro, less engine, propeller, starter, instruments. Will sell whole or parts. Air starters, Continental, $85; J6-9, $100. Wood propeller hub, $25. J6-9 propeller, $95. Lycoming propeller, $100. Jerry Kelsey, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

BULL PUP: One of the best jobs in the country. We have bought most of the Buhl Aircraft factory and still have a big slew of various instruments, parts, accessories, spruce, etc., too numerous to mention in this ad. Send in inquiries for prices. Sun Aero Motors, 10529 Gratiot Avenue, Detroit, Michigan.

FOR SALE: Factory equipment, tools, jigs, dies, patterns, blueprints and stock of parts for the manufacture of the skylark two-place training and sport plane. Approved with three different engines. Write Roland Pierson, 926 Riordan St., Muskegon Heights, Michigan.

LYCOMING ENGINE PARTS at a bargain. Stinson SM8A; also 1933 Reliant; Wasp all metal Flamingo; low-wing Spartan Trainer; four-place 300 h.p. Spartan Cabin, like new; Curtiss-Jr.; OX Robin. New and used instruments, generators and control boxes. Large supply of plain and corrugated sheet dural and aluminum. Also sheet steel, tubing and angles. The Vermilya-Huffman Co., Lunken Airport, Cincinnati, Ohio.

POSITIONS WANTED

TRANSPORT PILOT: 5 years experience. Desires connection either with private party or company. Employed now. Position with future wanted; salary secondary. AERO DIGEST, Box 1962.

TRANSPORT PILOT: 22, single. Approved school graduate. College education. Experienced all types of flying. No reasonable proposition refused. References. AERO DIGEST, Box 1963.

YOUNG MAN: 25, married, High School graduate, capable, ambitious, desires job in aviation which leads to future. Chief interests: aviation, mechanics, radio. Go anywhere. Salary secondary. Now employed. Could take training course. References. Henry F. Cordes, Hayward, Oklahoma.

YOUNG MAN: Single, 26, practical experience in aircraft. B.S. Electrochemical Engineering, Penna. State College. Desires position in aeronautical field. Must have future. Hard worker, cheerful, normal physical characteristics. Best references. Now employed. Box 266, Manheim, Lancaster Co., Pennsylvania.

TRANSPORT PILOT: 1200 hours; experienced in every phase of commercial flying, In all parts of U. S. and Mexico. Go anywhere. Fremont C. Rohrer, Cochrane, Wisconsin.

AVAILABLE for 3 months: Pilot, over 12 years experience, over 3,000 hours. Licensed mechanic. Excellent reputation. Permanent connection considered, but must be good. References required and given. AERO DIGEST, Box 1966.

TRANSPORT PILOT with mechanic's license desires position flying. Age 23. Seven years flying experience, including barnstorming and student instruction. Will go anywhere. Can furnish reference. AERO DIGEST, Box 1975.

YOUNG MAN: 25, transport pilot, Army trained, college degree. Experienced in all phases of flying. Excellent references. Neatness, personality, character assured. Desires position with private party or reliable concern. Reasonable pay expected. Write AERO DIGEST, Box 1974.

YOUNG, EXPERIENCED and trained welder, airplane and engine mechanic. Desires work on airport or will travel. Will accept 75% of salary in flight instruction and would consider parachute jumping. Cole Strong, Box 151, Estancia, New Mexico.

TRANSPORT PILOT: A & E mechanic. Married. Age 36. 10 years experience in various phases of flying and maintenance of aircraft. Desires employment with company or private owner. Clean record. References exchanged. AERO DIGEST, Box 1973.

AERO ENGINEER AND DRAFTSMAN: 1½ years experience in the design and construction of light planes. 26, free to go anywhere. Interested in a permanent position with future. AERO DIGEST, Box 1971.

BOY, 20, DESIRES POSITION in aeronautical field doing anything. Two years Brooklyn Technical High School, also graduate Central Industrial High School of Aeronautics. Three years airport mechanic's experience. Howard Adelson, 2701 Avenue R, Brooklyn, New York.

WANTED TO BUY OR TRADE

WANTED: Great Lakes or similar ship. Prefer job needing recovering. Give details. Middle west seller preferred. Price it right. E. Renfroe, 4646 Michigan Avenue, Chicago, Illinois.

WANTED: We pay cash for OX Wacos, OX Travel Airs and OX Birds, regardless of condition. Give full description and price in first letter. Mackey Flying Service, Findlay Airport, Findlay, Ohio.

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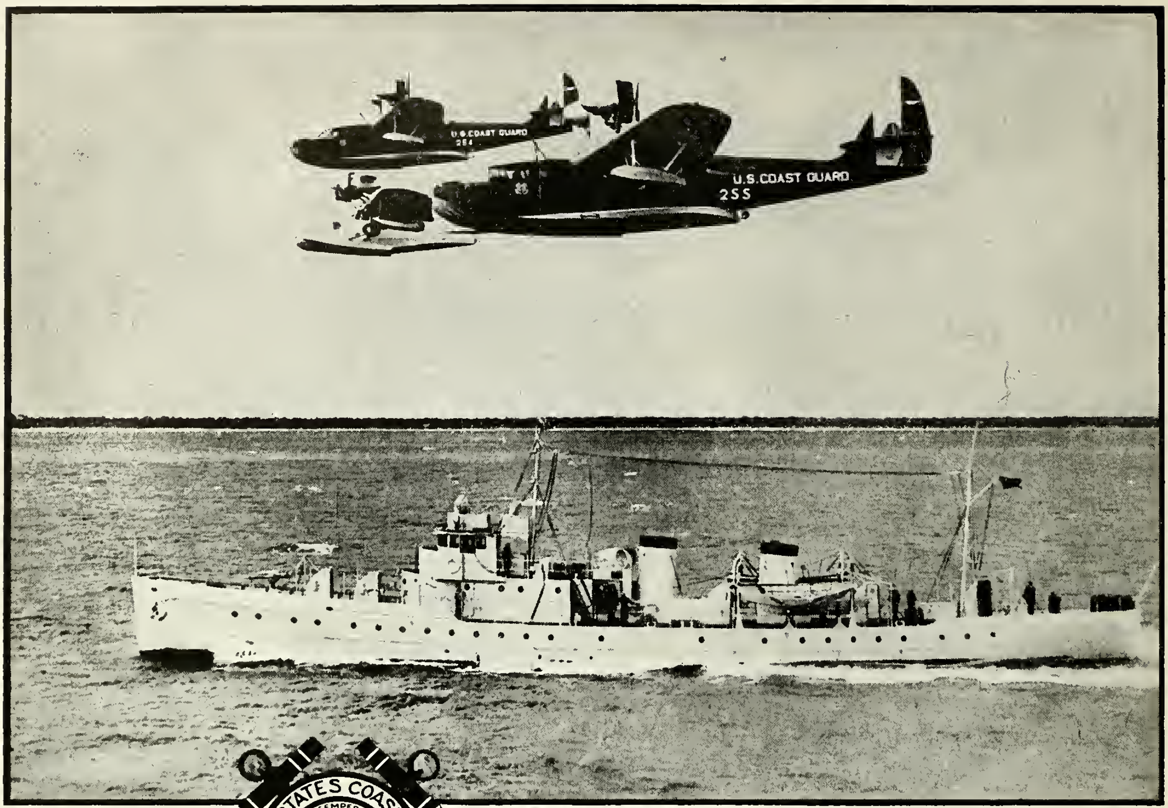

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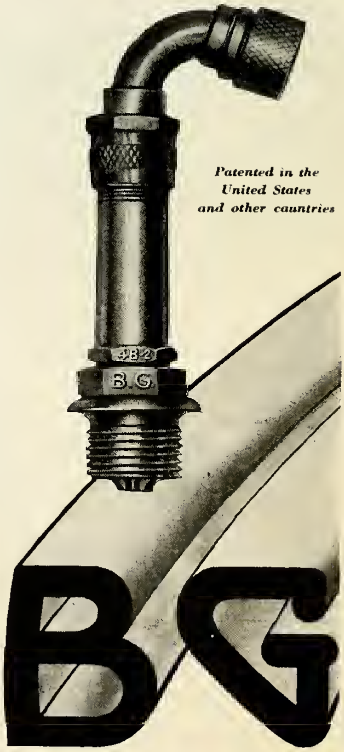

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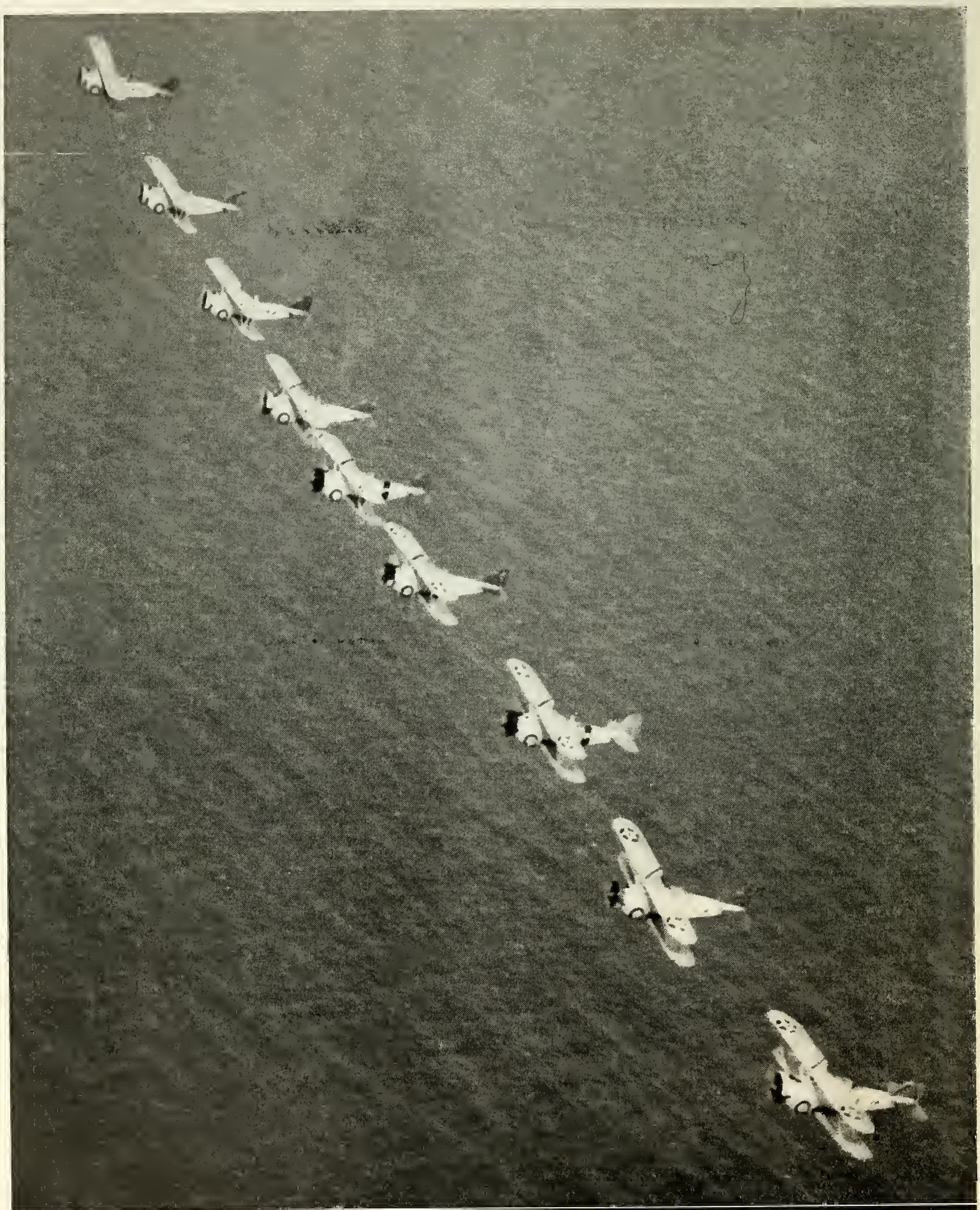

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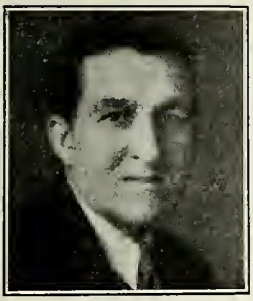

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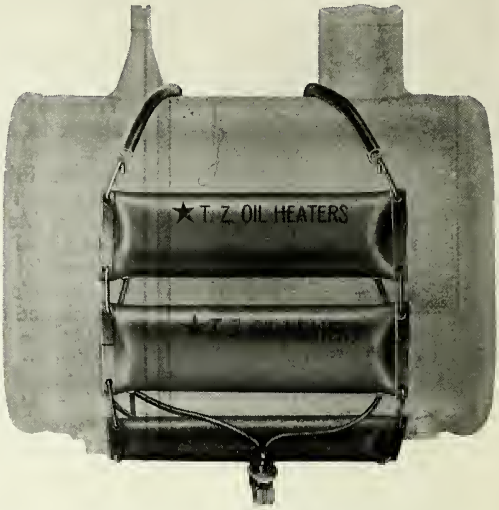

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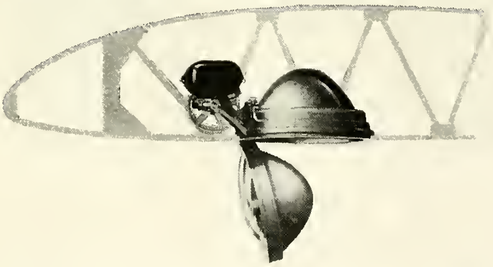

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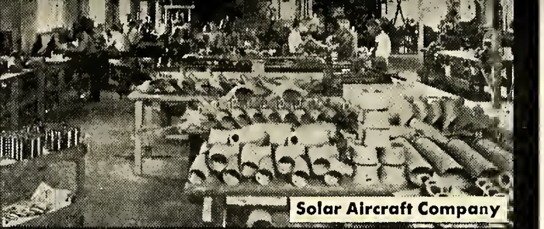
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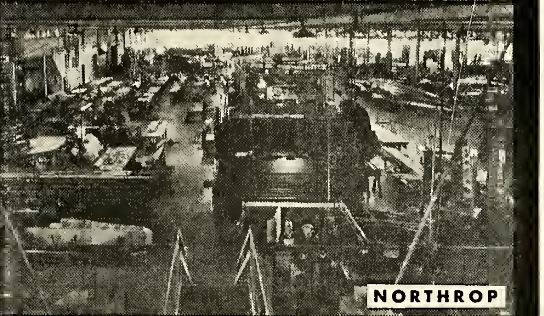
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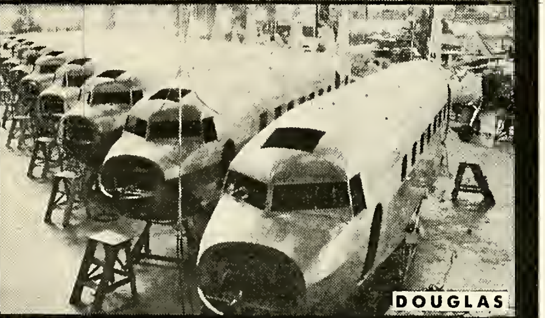
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The new Ryan Master Mechanics' Course offers a score of distinctive benefits, including:

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1750 HOURS.
Practical, Intensive Training

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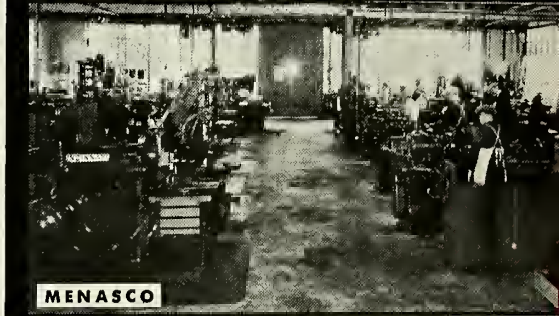
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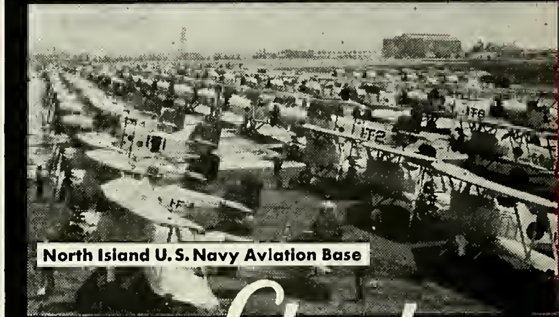
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VOLUME TWENTY-SIX NUMBER THREE

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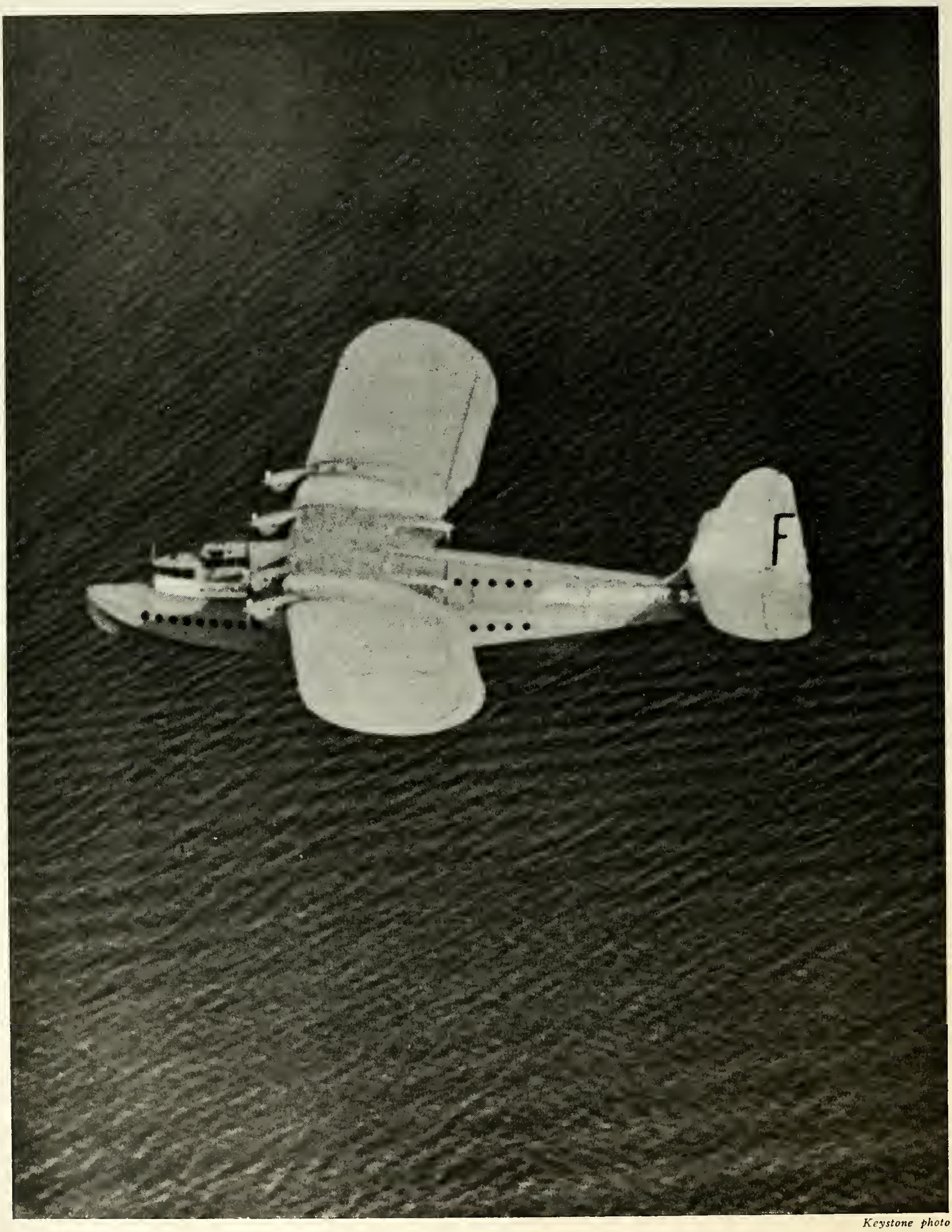


Keystone photo

Powered by six 860 h.p. Hispano Suiza engines, the French Latecoere "Lieutenant de Visseau Paris" takes off on a test flight. In the trans-Mediterranean service it will carry 78 persons, or 38 across the Atlantic

AIR

Hot and Otherwise

●

FRANK A. TICHENOR

● Every time a dirigible disaster occurs, it is followed immediately by a free-for-all fracas between the antagonists and protagonists of lighter-than-air. The airship's enemies leap to the opportunity to deal a death blow while the rigid dirigible is flat on its back. Its friends jump in to defend its prostrate body. In the whole melee there is bellowing from both sides, but very little logic from either.

With the recent loss of the *Macon,* they are at it once more tooth and nail. The same platitudes, the same old arguments. We all know it by heart by now: "Give the airship a chance" . . . "Stop this terrible waste of lives" . . . "If the Germans can build them successfully, we can too" . . . "Nobody but the Germans can build them" . . . "A crime against the taxpayers to spend another cent on them" . . . "A crime against the taxpayers to stop now without achieving success" . . . "The awkward monsters are structurally unsound, always have been and always will be" . . . —And so far into the night.

All of this shouting makes little sense. To be sure, there are snatches of truth here and there in the din. But only snatches, because the mental *r.p.m.* of men with overheated brains quickly drop and their reasoning power doesn't run smoothly.

Perhaps the principal reason there is so little straight, honest thinking on this subject is that so many on both sides of the so-called debate are motivated by greed. The heavier-than-air crowd wants all the money being spent on airships to go into the purchase of airplanes. The lighter-than-air contingent wants more and more money appropriated for dirigibles. With such great sums involved, both sides stoop to almost any subterfuge to gain their end. We have recently witnessed an example of this in the Federal Aviation Commission where lighter-than-air men took advantage of their favorable situation on the Commission to sponsor recommendations for airship construction which cross the boundaries of common sense. Now, as a result, they are paying the penalty of the President's displeasure. Because they tried to grab too much, they have succeeded only in postponing indefinitely a really worthwhile airship development program. At the start, AERO DIGEST predicted that, if the commissioners let personal ambitions or previous condition of employment or public position influence their judgment, they would only defeat their own ends, because they would be helping defeat the progress of American aviation. The loss of the *Macon* has only served to hasten the fulfillment of that prediction.

* * *

In order to arrive at the right solution to the dirigible problem, we must first answer three premising questions. And in finding the answers to them, we must throw off the cloak of prejudice and stop our ears to the squawking of the airship's friends and foes alike. Those three questions are: (1) In the light of past experience, can the rigid dirigible ever be expected to become a safe, sound ship of the air? (2) Does the potential utility of the airship justify its existence? (3) Is the expenditure of such large sums on single lighter-than-air units warranted by the prospects for structural perfection and the possibilities of practical employment of Zeppelin airships?

The first of these questions is the easiest to answer. (In fact, it is so easy that lighter-than-air promoters generally use it as their sole argument, despite the fact that by itself it means nothing.) There is no reason whatever to believe that the structural deficiencies of rigid airships cannot be eliminated. The world's experience with rigids—and our own experience particularly—has been quite small. Since 1900 when Count Zeppelin built his first airship, less than 200 all told have been constructed by all nations of the earth. The Germans have laid down the greatest number; they are now completing their 129th. Great Britain is a bad second with seven. America is a trailing third with only three. Most of the British and apparently all of the American rigids were structurally defective and went to their doom because of that. Even before the war, however, the Zeppelin works at Friedrichshafen had turned out about twenty dirigibles; of these only two were destroyed in flight, and eleven were still in service at the outbreak of hostilities. During the war about a hundred more were built, but they must largely be discounted in answering the question of structural perfection because so many were shot down or destroyed in their hangars by Allied bombers. Even at that, however, twenty-one survived the war. Since the war Germany has built only five airships. Of these one is not yet in commission, and two—the *Graf* and our own *Los Angeles* —have shown themselves to be made of mighty stern stuff.

Now, no one in his right mind could say that this experience is completely a black mark against the inherent structural soundness of the rigid. Even if it were, it is not adequate to be conclusive. If no more than 200 airplanes had been built since the original Wright, we should perhaps have achieved a degree of structural perfection even lower than that of the Zeppelin. It is not the American way to throw up our hands and say, "It can't be done." It *can* be done.

Even with faith that American ingenuity can achieve structural soundness for the rigid, we must decide whether the dirigible's usefulness will be great enough to justify our pursuing that end. Undoubtedly in the last few years the great strides in the airplane's range, speed and payload has diminished the potential utility of the airship. Nevertheless lighter-than-air craft still have some marked theoretical and actual advantages. Despite their low speed, their superiority in endurance in terms of air hours is indisputable. Once mechanical perfection has been attained, they will also gain a very high degree of safety—especially in America with our monopoly of helium—for they will not be subject to the mishaps of motor failure, blind flying through storms and the like. Finally, it will probably be some time yet before the airplane can match them in load-carrying capacity.

* * *

However, it must be admitted by even its staunchest defenders that the rigid's usefulness will not be as great as it once showed prospects of being. Consequently, the great expenditures which formerly seemed justified must now be questioned. And therein lies the crux of the whole problem.

If we would carry on to success on the mechanical side of airship construction, if we would take advantage of the airship's prospective utility, we must yet find a way to do these things less expensively. Four to six million dollars per unit is far too much to spend upon craft which are still essentially experimental.

How, then, can America continue its airship program on a less costly basis? Possibly it can be done by concentrating on smaller airships. Possibly we leaped too quickly to the giants. Although they were but the second and third Zeppelins we had ever constructed, we concentrated on making the *Akron* and *Macon* the biggest in the world. Let us forget size; let us concentrate, not on building the biggest, but the *best* airships.

Improvements in Lighting at Tacoma

●

R. LESTER KELLY

Commissioner, Pierce County, Tacoma, Washington

● Seven miles south of the Tacoma, Washington Post Office, connected with the city by excellent roads and adjoining the Fort Lewis Military Reservation is the 980-acre tract which Pierce County set aside for Tacoma Field. With $300,000 realized from an airport bond issue, the county commenced construction in 1929 and since that time has carried forward an extensive improvement and development program which has brought the project to the point where it is one of the finest in the northwest.

The field was originally laid out as a circular, all-way unit free from obstructions, measuring 3,000 feet in diameter and providing one 5700-foot runway.

The soil, of heavy glacial wash, is a portion of the surrounding prairie, and in its original construction there were necessarily many cuts and fills which required a year or two to settle into such shape as to provide a satisfactory surface.

A modern, steel frame, concrete tile and glass hangar, 236 ft. × 112 ft., was constructed, and shops, office and dormitory facilities were made an integral part of it by the construction of a bay on the north side. Separate buildings for restaurant, garage, machinery storage and dope shop were also provided.

Developments carried forward progressively resulted in securing an A-1-A rating in December 1932, but when the Department of Commerce announced the A-T-A designation it was desired that the field qualify for this rating if arrangements could be made for the necessary construction work. At that time the principal requirements were lengthening three runways to 3500 ft.

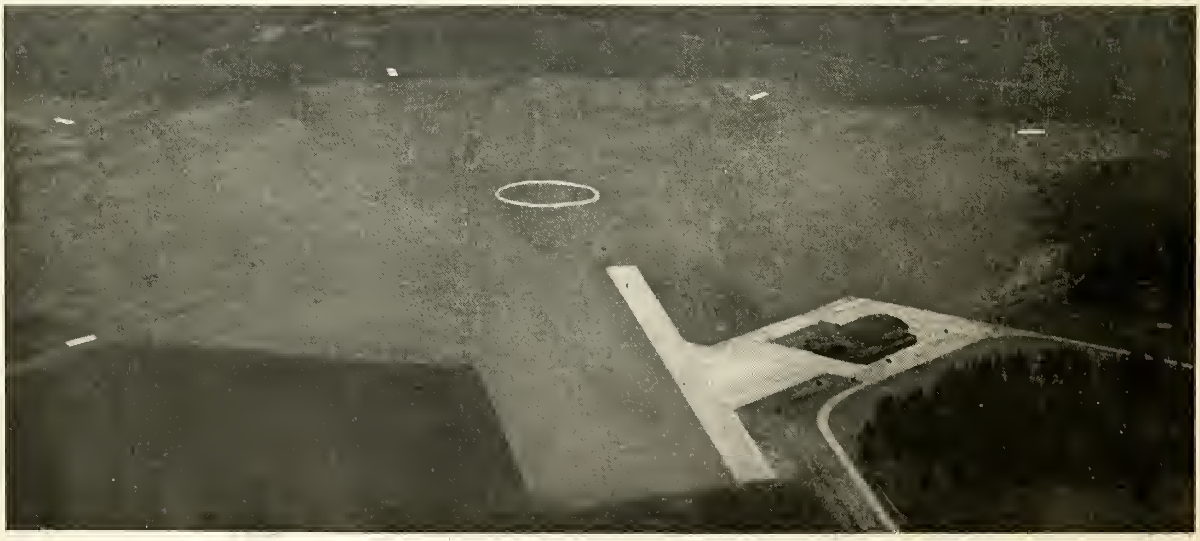
Plans were accordingly laid and when the Civil Works Adminstration operations were first announced, designs were drawn and proper application filed. The project was approved and the work began in November 1933, continuing uninterrupted until March 1934. During this period an average of 322 men were employed daily and $180,919 was spent, of which $73,582 was for materials. A compilation of the finished work showed that 37,897 sq. yds. of pavement were laid, aprons about the hangar were completed and the road leading into the airport was paved. The airport work also provided a take-off strip on the principal runway, 1500 ft. long and 70 ft. wide, the necessary taxyways, as well as seven warm-up strips at several points about the field, making a total of 41,000 sq. yds. of pavement. The 230-ft. marker circle in the center of the field was also provided with a 5-ft. band of cement pavement.

The amount of cement purchased was slightly in excess of 37 carloads; there were 22,809 cu. yds. of sand and 4,543 cu. yds. of gravel used. At a later date, with the cooperation of the Washington Emergency Relief Administration, two strips of cement were laid on the east runway, 10 ft. wide and 1400 ft. long, with a 50-ft. gravel area between, which will later be oiled to furnish a take-off strip for that runway. During this period, 111,864 cu. yds. of earth were moved to lengthen the runways, and it is anticipated that with the assistance of the Washington Emergency Relief Administration sufficient additional grading will be undertaken to meet the A-T-A requirements.

One of the most important developments under this program was the changing of the lighting system. The original installation, made in lead-sheathed cables, was not satisfactory in this type of soil, and developed many short circuits. Night lighting previously was accomplished by two 24,000,000 c.p. banks of floodlights, one to the northeast and one to the southwest. While considered the best arrangement for this type of lighting, it was far from satisfactory, and a new plan was developed to furnish proper illumination from all angles.

The banks were broken up and the individual 3,000-watt lights placed around the field on sixteen 18-ft. steel towers. In addition, 2 new lights were mounted on the hangar roof, making (with the other lights) a complete circle around the field. Secondary floodlights of 1,000 watts each were mounted to illuminate the triangles created between the larger lights, and also the ends of the runways which project outside of the circle.

Primary floodlights are 32 volts and



Recent view showing the layout of Tacoma Field, which is provided with several unique lighting features receive current from 3,000-watt 4,000/32-volt transformers enclosed at the base of each tower and supplied with 4,000-volt feed through a remote control oil switch, also located in the base of the tower. The secondary floodlights are 110 volts, supplied with current from a 4,000/110-volt transformer located in the base of the nearest tower. Both the primary and secondary floodlights are controlled by a pistol-grip drum-type switch, by which the circle of lights around the field is divided into eight sectors, individually lighted to illuminate the field in the path of an incoming plane. When a plane is landing from the northeast, the pointer on the dial is set for the northeast and the grip is pulled upward about ½ in. This turns on from 6 to 8 of the primary floodlights and all the secondary lights in that area, illuminating the field in the path of the plane and behind it, so that the pilot does not face any lights. The entire illumination always comes from the direction in which he lands. In this way the entire field can be illuminated by sectors to the requirements of .12 ft. candles.

This new lighting system has found considerable popularity with all of the transport pilots using it, and the centralization of control in the drum-type switch makes errors on the part of field personnel practically impossible, being simple by comparison to the usual method of individual switch control.

The double drum beacon, now moved to a new location, consists of a 24-in. white and green flashing beacon, revolving 6 r.p.m., with a beam candlepower of 7,000,000 and automatic lamp changers.

Another interesting departure from standard practice was the placing of green lights directly across the end of the runways and the boundary circuit, 1 light at each end of the least used runway, 2 at the next least important runway, 3 lights at the ends of the E/W runway, (which is often used) and 4 at the ends of the NE/SW runway, which is in the prevailing wind and is generally used.

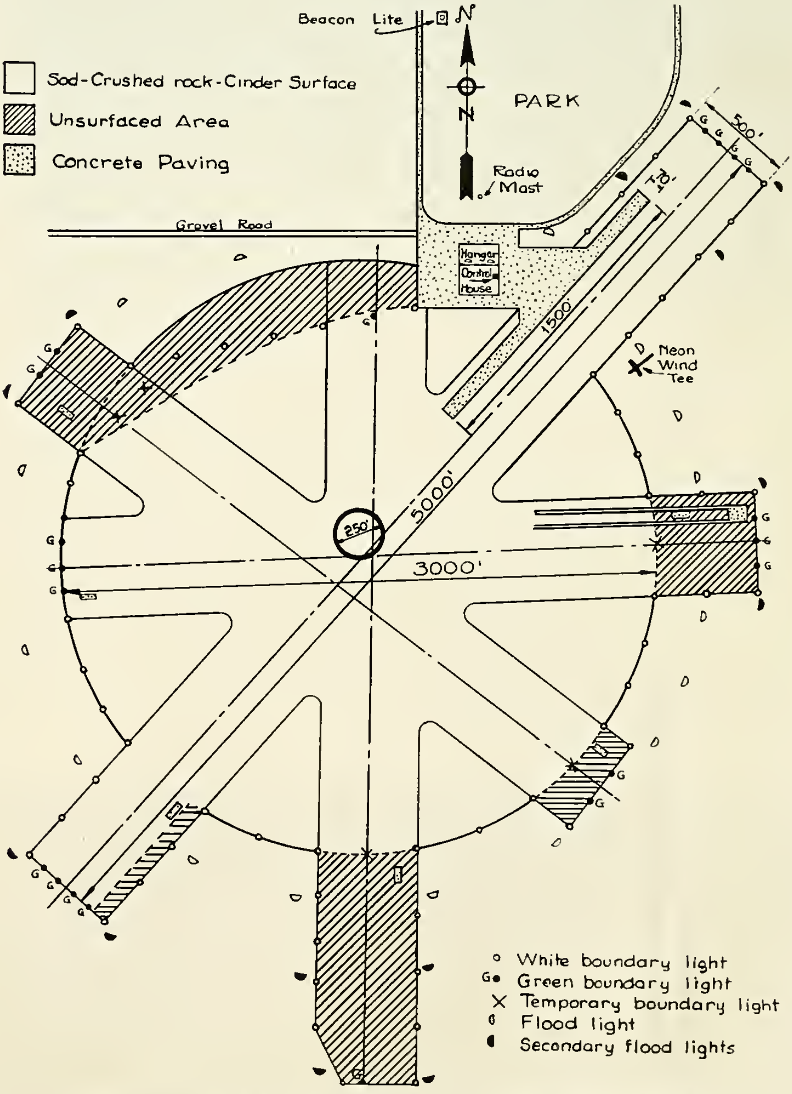
Due to the necessity of using old materials, the boundary lights are made of standard fittings supported on 4-ft. lengths of 1¼-in. galvanized iron pipe, set in a concrete base, which also houses a cast iron safety coil skirted with the customary galvanized iron cone. This system consists of 3 series circuits sufficient for 1,000 lumen lights. Current is supplied through three switches mounted in the substation, with the remote control in the control house.

The wind tee, which is outlined in green Neon tubes, is also supplied with current through a safety coil in the boundary light circuit. Obstruction lights are standard waterproof fixtures supplied with power from the boundary circuit. As the beacon is some distance from the substation, it is supplied with current direct from a transmission line outside of the airport, but is controlled from the control house switchboard, as is also the ceiling light.

All of the lighting circuits are controlled from a small panel in the control house, which is located on the hangar apron. The control house has a glass roof and sides to provide maximum visibility and is equipped with a remote control for the radio transmitting and receiving sets. Thus one operator has all the facilities at his command and is responsible for the entire control during landings and take-offs.

Cable placed in the original construction of the field could not be used for this development and was abandoned. All of the circuits consist of some 125,000 ft. of non-metallic sheath underground cable of various sizes laid in ditches around the field. It was possible to make the entire installation without a single splice, outside of the tower enclosures, which are concrete based. For the wiring in each tower, the underground cable is strapped up on the enclosure walls with fitted straps and stove bolts. The connections to the switches and transformers are carefully made and all entrance bushings are filled with insulating compound. All returns on the secondary floodlights and boundary lights are grounded by running a heavy ground wire around the field and by building a permanent ground in a drainage sump at the substation.

A graphic watt meter was installed as a telltale on all operations and the latest devices necessary for a modern installation were utilized. The cost of new electrical material amounted to about $19,000.



Diagrammatic plan of Tacoma Field and its distribution of lighting

Future of Air Warfare

CY CALDWELL

The airplane is an offensive (not a defensive) weapon. It is impossible to prevent attack from the air, and the only effective means of combating such attack is by another attack in kind. Hence we come to the conclusion that air warfare in the future will resolve itself into main attacks, not against armies and navies, but against the manufacturing, financial, and political centers of the nation itself. Nations mobilize their entire industry for war purposes; air warfare will carry the war to the places where all the weapons of war are forged—in the factory, in the bank, and in the halls of the politicians

● The United States has no Air Force. What air power it possesses is divided between the Army and the Navy, to be used as an auxiliary of the Army and Navy, to scout for them, to engage enemy aircraft in combat, and to bombard military and naval objectives. In average Army and Navy minds, the Air Force, as an integral power, does not exist; it is considered merely an adjunct of the old established land and sea forces. And while at last it is freely admitted, even by the most conservative military and naval officers, that the army or navy without adequate aerial auxiliaries would be blind and helpless, such officers, honestly convinced of the rightness of their beliefs, will argue for the continuance of the present American system of divided air strength.

The naval officer has by far the better case to support. He will maintain (and rightly) that aircraft operating over the sea must be based upon the sea, on a ship floating upon the water, or else base on land and restrict its over-water area of operations to its flying range, which is limited by its gas capacity. Hence, says the naval officer, aircraft operating over the sea can operate only as an auxiliary of the surface navy—for the aircraft carrier would be unable to remain afloat and defend itself against enemy surface craft without the defense it receives from the surface navy as a whole. Admiral Sir Herbert Richmond, formerly of the Royal Navy, expresses the whole trend of naval thought when he classes aircraft with destroyers and light cruisers, and refers to them as the "Air Flotilla." It may be more fitting to refer to the air and sea forces of the future as the Air Force and its Sea Flotilla, which will comprise, as it does to-day, battleships, cruisers, destroyers, submarines, and aircraft carriers, under the supreme command of the Chief Air Marshal.

In passing, let me refer briefly to the fact that even to-day, with the aerial auxiliaries in a distinctly subordinate position as compared politically, financially, and physically to the land and sea forces, it might be of distinct advantage to the admiral in command of a battle fleet if he would leave his battleship at the beginning of the action and get himself up where he could see something, and thus more intelligently direct the course of surface operations. If Admirals Jellicoe, Beatty, and Scheer had been able to place themselves in three of our modern fast airplanes, with radio communication with their surface fleets, the Battle of Jutland in May, 1916, would not bear evidence that it was fought as though the fleets were under the command of three blind mice. None of the admirals could see anything, none of them had accurate information about the forces and positions of the enemy; and with nothing much to go on they directed their fleets by guesswork, achieving results which surprised nobody more than themselves.

The Army officer who declares that air power should remain forever a mere auxiliary of the Army, has no case. If the Army officer has not had extensive aviation training—as the average senior officer in our Army has not had—he is not in a position to arrive at a fair valuation of an arm of warfare about which he knows little; his opinion, honest though it undoubtedly may be, is restricted by his professional training. He thinks in terms of numbers of men, operating against other numbers of men, all of them on the ground, moving along roads, on foot and by motor vehicle, using railroads, bridges, defensive works and trenches. He thinks in masses, thrown against other masses; he thinks in quantity rather than in quality; in weight of metal hurled at obvious military objectives, attainable by ground forces, rather than in less obvious objectives that can only be reached by Air Forces.

Hence when the Army officer tries to envision modern warfare he almost invariably pictures a war that resembles that of 1914-1918, which saw only the birth of military aviation. He pictures squadrons of bombers coming over to bomb what 17 years ago were called military objectives, such as railroad stations, ammunition dumps, aerodromes, roads, and other communication lines; he pictures squadrons of pursuit aviation battling with enemy bombers and with enemy pursuit ships; he pictures artillery observation sighting for the guns, drawn up in orderly array behind the trenches; he sees attack aviation bombing and machine-gunning trenches and roads—and calls it air power instead of what it is: *auxiliary* aviation of the Army, so defined by the late Gulio Douhet, Italian general.

This auxiliary aviation of the Army must, of necessity, be used to further the ends of the Army, to scout for it, to hamper the movements of the opposing army and that army's air auxiliary; it cannot be used against the *natural* objectives of air power without weakening the army by the loss of its services. Hence the U. S. Army Air Corps is not equipped

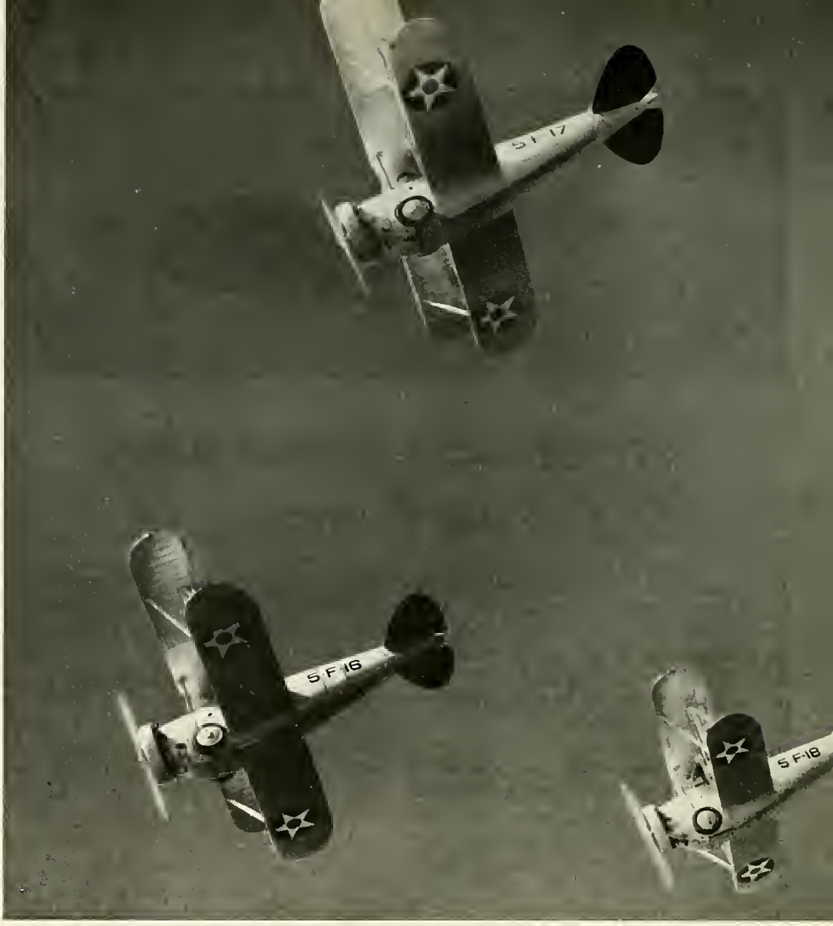
Army Boeing pursuit planes

as an Air Force, it is equipped and trained as an army auxiliary, with a preponderance of observation and pursuit aviation, with a smaller proportion of bombing planes. Such a corps is not, and by its physical nature cannot be, an Air Force; its officers cannot even think like the officers of an Air Force, free to plan the use of air power to its best advantage; always they must think in terms of Army, the ground army, fitting their aviation program to the army necessities of scouting, artillery observation, and the bombing of army, as distinct from air, objectives.

At this point it may occur to the reader that the writer, a proponent of air power, might be as unfitted to judge an army's ability to use air power effectively as he has declared an army ground officer to be unfitted to attempt a fair valuation of air power. That, of course, is granted, with this reservation: the natural procedure of an army is known; the natural procedure of an Air Force is not known, for it has not yet been used in warfare. Hence it is fitting and proper for me to presage an army's procedure in the future on its procedure in the past, for armies have not changed in any physical essentials since 1918. But air power *has* changed with the technical advances of aviation; to-day, as an offensive weapon of great mobility, it is without an equal on land or sea; and only one who has grown up with it and lived with it can see even dimly into its future.

What will an army do in the next war? Obviously, as it is essentially unchanged since 1918, it will have to do what it did in the war of 1914-18—dig a series of holes, and get into them. In fact, what development there has been in army equipment has made it even more certain that armies in the future, as in the immediate past, will have to burrow into the ground and stay there for the duration of the war, which will be fought to determine which nation loses its resources of men, money, and materials first. That nation will be the loser, quite possibly without any decisive defeat having been administered to its armies, as was the case with Germany in 1918. With the increase in small arms such as machine guns, defensive positions will be much better held, and entrenched armies will be even harder to dislodge; the war, so far as both ground armies are concerned, will degenerate, as the last one did, into a war of attrition, of wearing down, with pushes here and there along a line of firmly held trenches—pushes which will result in tremendous losses and only slight gains, as in the war of 1914-18.

And this is not to say that therefore an army is unnecessary; air power has not yet demonstrated its ability to win conclusive national victories unaided by ground and sea forces; and the old and tried must not be discarded for the new and untried, no matter how obsolete they may appear to airmen. On the other hand, the older services should not be permitted to hamper the development of the new; and a branch of National Defense such as the Army, which will be unable to go anywhere except underground, is taking a great deal on its shoulders when it dares to direct the activities of a form of defence which can go everywhere—and no ground army can prevent it from going anywhere.



Navy Grumman two-place scouts

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And where will the airplane go and what will it do in the next war? It would be better to ask, where *must* the airplane go and what *must* it do for its capabilities and functions are so obvious, its use is so definitely restricted to that of an offensive weapon, that I have no hesitation in stating that it will be used chiefly to bombard objectives far beyond the range of land-based or sea-borne artillery. All other uses to which airplanes in warfare will be put must be secondary to this one all-important use. There will, for instance, at least in the earlier stages of the war, be scouting and reconnaissance airplanes, and artillery observation planes; but these functions will be performed, not by planes of the modern Air Force, but by the aviation auxiliaries of the Army and Navy. And it should be remembered that the Air Force, the aerial hitting power of a nation, will be weakened by the amount of aviation personnel and material that is diverted to these subsidiary and less important uses.

Considering now a modern Air Force—it will consist chiefly of bombing machines which will proceed against a series of carefully selected air objectives, the destruction of which would seriously hamper the conduct of the war. An enemy Air Force attacking the United States, would for example, proceed immediately to destroy the two factories on which the U. S. Army and Navy are at present solely dependent for aviation engines—that of Pratt & Whitney at Hartford, Conn., and that of Wright at Paterson, N. J. Destruction of these two factories, easily accessible to bombing aircraft from an Atlantic fleet or from Canadian bases, would seriously hamper the further production of engines, if it did not stop it entirely for some time and thus render it impossible to replace our own losses of aircraft before the enemy had won a decision. Aerial bombardment of munitions plants, most of which are on the Atlantic seaboard, would be inevitable, as would the bombardment of Navy yards and ship-building plants, so that we would be hampered not

(*Continued on page* 70)

Swissair operates two Lockheed Orions between Zurich-Vienna

Air-Minded Switzerland

M. D. WILLIAMS

● Switzerland is keeping pace with the trend of the times by promoting aviation. True, the land of the Alps covers an area of only 15,737 square miles, but this seemingly limited flying territory offers a variety of scenery which cannot be duplicated anywhere. Seasoned pilots, who have for years flown over this country, are still discovering new charms in the landscape revealing itself below them.

The airplane passes over lakes and rivers, over villages and towns, which have preserved ancient styles of architecture and time-honored customs and traditions. As it continues its flight, it flies over pastures, where the alp-horn and yodel have their home, and up to the sphere of glaciers and snow-capped peaks. Valley succeeds valley, some with familiar landmarks, others even unknown to native passengers, and a new Switzerland unfolds itself from the air.

The popularity of air travel in Switzerland has increased, after the numerous international airlines (with which the country is linked) became a well-established fact.

Round-trips and excursions over the Alps are flown from the airports at Basle, Berne, Geneva, Lausanne, St. Gall and Zurich. A seaplane service is also available during the seasons in such tourist centres as Interlaken, Lucerne, Lugano and Locarno, where aircraft can be hired for short or long trips and Alpine flights.

Sightseeing flights, in cabin planes, over the cities of Geneva and Zurich, are available at about $3.50 per person; over Berne and environs at $4; over Lausanne and the surrounding territory at $3.50, $4 or $5 and over Basle or St. Gall and their outskirts at $4 or $5. Alpine flights, lasting from approximately one hour to three hours are available from any of the airports mentioned previously, the rate of these sightseeing flights ranging from about $10 to $65. These latter excursions include mountains such as the Säntis, Glärnisch, Tödi, Rigi, Titlis, Jungfrau, Finsteraarhorn, Blümlisalp, Matterhorn, Mont Blanc, and the Bernina range and other peaks in the Grisons.

From the airports in Basle, Berne, Geneva, Zurich and St. Gall-Altenrhein, charter flights in heated cabin airplanes are also available at any time to any place in Europe and the adjacent continents.

The well-known Swissair company, with offices at Zurich, Basle and Geneva uses tri-motored Fokker planes for Alpine flights, making most of these trips during the morning hours when, according to experts, the air is calmest, and the contrast between the deep valleys, the sombre crags and white peaks shows most forcibly.

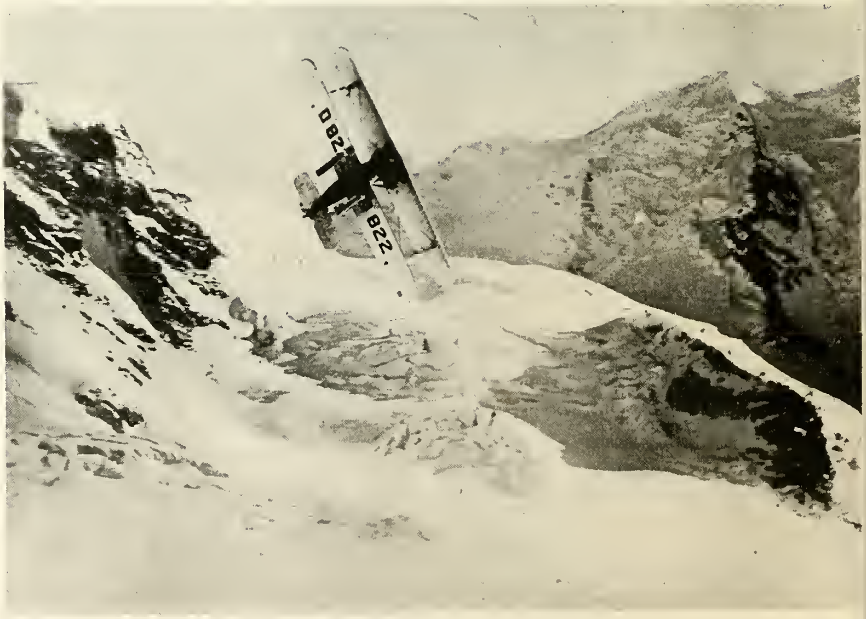
The warm, comfortable planes are equipped with large windows, affording an unobstructed view so that photographs can easily be taken from the cabin.

Alpine flights are made only in clear and favorable weather, the air transport companies always keeping in touch with the chief Swiss Meteorological Office, for their weather and visibility information. The maximum altitude reached on a one-hour-flight is about 6000 feet; on a two-hour-flight the plane may rise to about 13,750 feet, and on a three-hour-flight it might go as high as 14,750 feet.

Swissair was the first of all European air transport companies to employ American aircraft. With two Lockheed *Orions,* the time taken to reach Vienna from Zurich was reduced from five hours to two and a half, and this express service has enabled all the capitals of the Balkans to be reached from Switzerland in one day. At the time these machines were bought, Swissair had confidence in their operation from a technical point of view. Propoganda in favor of tri-motored aircraft had been carried on so insistently and so much had been made of the slogan "tri-motored" that Swissair doubted whether the public would favor the introduction of a machine with a single-engine. The results of the service have proved that these doubts were entirely unfounded.

Except for one or two of the more

Aircraft are utilized in the search for missing tourists



One of the Douglas planes added to Swissair's fleet

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popular services, passenger traffic is more or less evenly distributed over the six months' season, and a careful study of an analysis of passenger traffic had shown that a series of international routes can be considered as paying services. A good example of Swissair astuteness in turning a non-paying service between two places into a profitable one was the connecting of Basle and Geneva with Zurich by air, so that a connection could be made with the early morning planes to Berlin and Vienna.

Generally, there is no doubt that Swissair's service as they stand at the moment are as efficiently operated as any in Europe. The company's continual regard for the convenience, safety and other requirements of commercial aviation is likely to keep it among the most successful of aircraft operating companies and seems certain to result in even more profitable operation.

During the past sixteen years many thousands of air passengers have safely been taken over the Alps. Besides, every passenger holding a ticket is adequately insured with a Swiss insurance company.

A few months ago the American press pointed out that in 12 years of operation not one fatal accident occurred on Swiss airlines engaged in the transportation of passengers, mail or freight. This high standard of aviation in Switzerland is attributed to a large extent to the ability of the pilots, who are men of long military and commercial experience. Swiss pilots are proficient in instrument flying and in landing safely in difficult regions in their own or other countries.

In Switzerland airplanes have for years been pressed into service to locate stranded alpinists, and food supplies, medical kits and blankets dropped to such parties from the air have frequently proven life-saving factors.

A Douglas airliner, the first of four of these high-speed transport planes, which have been ordered by Swissair Company reached Dübendorf-Zurich airport from Amsterdam in December, 1934.

Efforts to stimulate interest in amateur flying in Switzerland have in recent times been made by the Swiss Aero Club in the form of air meets, tours and formation flights. Foreign pilots planning to visit Switzerland on a holiday jaunt are assured of a most hearty welcome by the club.

For the summer season Switzerland will be served by the following airlines: Swissair will fly the Geneva-Berne-Zurich; Basle - Zurich - Munich - Vienna; Zurich - Stuttgart - Leipzig - Berlin; and Lausanne-Geneva - Paris - London routes. Together with Lufthansa, it operates lines between Zurich and Amsterdam via Basle, Mannheim and Frankfurt; together with Air France it covers the route between Zurich-Basle-Paris-London. Lufthansa serves Zurich and Budapest, via Munich, Salzburg and Vienna; Stuttgart and Barcelona via Geneva and Marseilles; Zurich and Frankfurt via Stuttgart; and Zurich and Mannheim via Constance, Freibourg im Breisgau and Karlsruhe. Imperial Airways provides a service between Zurich, Basle, Paris and London, and Air France furnishes a service between Geneva, Lyons, Paris and London. L'Alpar of Berne serves the inland routes of Basle-Berne-Lausanne-Geneva; Berne - Bienne-Basle; Lausanne-Berne; and Geneva-Lausanne-Berne - La Chaux de Fonds - Le Locle-Basle. L'Aero St. Gall provides a service from St. Gall to Zurich and Berne and from St. Gall to Zurich.

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Mt. Matterhorn in the Valais as seen by the aerial tourist

Switzerland's air-mindedness extends even to the many airports found in almost every section of the country. There are three airports classed as first-class by reason of their equipment with radio and meteorological facilities. These are at Basle-Birsfelden; Geneva-Cointrin; and Zurich-Dübendorf. Second-class airports are at Lausanne, Berne and Altenrhein, while La Chaux de Fonds houses a third-class airport. Regular customs seaplane bases are at Geneva, Lausanne, Locarno, Lugano, Rorschach, Romanshorn, Zurich, Ermatingen, Kreuzlingen, Arbon and Altenrhein. At Bienne there is an airport for internal traffic.

Military aviation in Switzerland is under the command of Colonel P. Bardet, who is directly under orders of the General Staff. There are army bases at Dübendorf, Thun, and Lausanne and the aerial equipment consists of Fokker CVEs, Dewoitine D-27 and DH5s, Fokker D VIIs and Dewoitine D26s.

Before becoming a pilot, students must take almost a year and a half of training, with flying instruction starting almost nine months after entering school. After attending the Pilots' School, the young officers are obliged to fly 100 hours a year for three consecutive years.

EDITORIALS

"After my two round-the-world flights, I realized that the future of high-speed transportation was in the higher altitudes, say from 30,000 to 40,000 feet, where atmospheric pressure and resistance are a fraction of that at sea level. So I decided to equip the Winnie Mae for such a flight to obtain data on conditions at these altitudes."—WILEY POST

Plastering the Postmaster General

● Our esteemed Lostmaster General has spent several uncomfortable days recently. There comes a time when one's imperfections finally catch up with him and Falling Jim Farley's are baying loudly and hilariously at his heels as he wiggles to rid himself of the stigma of his incomprehensible actions.

Early in February he was unceremoniously dropped a peg by the District (Washington) Court of Appeals which decided that his summary cancellation of air mail awards was a breach of contract. No mention was made of the breach of the public's peace of mind as twelve of their Air Corps pilots crashed to their deaths and millions of dollars were lost while the Army was valiantly attempting to carry the mail. The court's decision was especially interesting because it shows that no politician is bigger and more influential than the Constitution of these United States. Farley thought he was, but finds now that his unorthodox and un-American tactics have exposed his government to a series of body blows in lawsuits which will cost it plenty.

Farley hardly had time to recover from his shock when he was again hung out on the limb for another airing, this time being saved from the chill blasts of an official investigation only by his Democratic allies in the house who voted down a resolution to look into his flagrant gifts of stamps to people to whom he was friendly. Foxey Farley back-tracked on these gifts almost immediately after the record vote in the House, but not before his philanthropy in imperfections brought considerable consternation in philatelic circles and criticism in the daily press.

In editorializing on the subject, the New York *Herald Tribune* reported on a mechanical error in the first government air mail issue of 1918 (which sent the value of the stamps to sensational prices) and then said "Mr. Farley may hesitate to issue a special series of stamps to commemorate what the Administration did to the air mail of the nation last year, and especially to the Army aviators who were called upon to carry the mail without adequate training or equipment. But the inverted airplane error of 1918 suggests the possibilities which lie open before him. If he is looking for appropriate stamps with which to commemorate the achievements of the New Deal here is surely one opportunity.

"The regular issue would, of course, display an airplane inverted and crashing. The two sheets of errors with the airplane righted, Mr. Farley would hardly wish to keep for himself. He might well decide to sell them in the open market, the proceeds to go to the relatives of flying officers killed while carrying the mails for the Postoffice."

The suggestion is a worthy one, yet we fear it will be found much too practical to appeal to Jumping Jim, dealer in wholesale imperfections in stamps and official decrees.

Still another slap in the already red face of Farley came in a resolution in the Senate to inquire into his private affairs, this more serious charge intimating that the New Deal Boss needed some investigation himself. Specifically, the charges allege that Farley's companies received orders to furnish building materials to the contractors of the new Post Office Annex in New York. Moreover, it is disclosed that the contractor was awarded the work only after four successive bids had been made, on all of which, except the last, another company was the low bidder.

Referred to the Post Office and Post Roads Committee, the resolution is expected to be reported shortly, at which time High Bid Jim will be called upon to explain a few things to the satisfaction of those who claim the evidence against him is so unanswerable that he would resign, or be removed from office before an investigation could be launched.

Our air mail contractors will follow the course of these proceedings with more than ordinary interest. Perhaps they now will learn what fraud and collusion really are, shown by the man who so artfully dodged the explanation of these terms during and after the air mail fiasco.

Paint at The Airport

● Proper use of paint at the airport means a great deal in the protection of life and property. It marks a field as distinctly during daylight hours as good lighting does at night. To the flier, a clearly-painted name on a hangar roof, and well-defined boundary indicators are welcome sights, particularly when the weather is poor and visibility impaired.

Aggressive and wide-awake airport managers can assist in establishing their fields as up-to-date and progressive by always keeping the buildings and markers painted and in trim. Not only for the sake of appearance and protection from the elements, but also for safety, paints of colors selected for their particular purpose should frequently be applied to wind tees, hangar roofs, field equipment, fences, marker circles, etc.

New paint is good insurance for better visibility and often spells the difference between safe and dangerous landings. More airports (including the smaller fields which are not in constant use, but which assume great importance in emergencies), will find it to their advantage to give more thought to such details.

The investment is one which will be found definitely profitable.

Maintaining Trained Pilot Personnel

● It would be sound business to give every unemployed pilot at least ten hours flying time each year in government-owned or leased aircraft to enable them to renew their licenses and build up a little time until a position is found.

Shackled by the ravages of the economic crisis, many transport pilots are finding it increasingly difficult to continue flying, and considering the advantages their training would mean to the government (if it ever needed them) it is apparent that very little thought has been given to the fact that many of these men are losing their keen flying edge because they cannot *afford* to fly.

Every year the Army, Navy and Marine Corps spend thousands of dollars of the taxpayers money in training pilots. The government makes a substantial investment in each man, instilling in him such a thorough and practical foundation in military aviation, that his equal cannot be found anywhere. After a few years however, many of these pilots are discharged from the service, free to follow any chosen career, but most of them are so imbued with their art, and are so attached to aviation, that they foresake many opportunities while hunting for employment in the work they love. They are therefore, thrown into a field where present conditions make it difficult to absorb them, and as time passes they slowly lose, through lack of practice, the training bought at such great expense by the government. Only flying time could prevent this.

Personalities

By Caldwell

● MY HOLLYWOOD scout, William Stull, A.S.C., sends me the biography of Lt. Charles A. Marshall, A.S.C., which isn't Army Service Corps but American Society of Cinematographers. When I was in Hollywood last summer Bill and I went out to Charley's home with the intention of taking notes for this biographical sketch; but the difficulties of holding a tall glass and a pencil at the same moment proved insurmountable, so I threw the pencil out of the window and concentrated on the glass, leaving Bill to send me details later. Bill is an author anyhow, so writing this stuff was just practice for him, besides being an act of charity to a fellow sufferer in the literary bull pen.

Like Elmer (The Great) Dyer, Charles Marshall specializes in aerial camera work, ranking right at the top of his profession. You have seen his fine work in "The Flying Fleet," "Sky Bride," "Hell Below," "Sky Devils," "Night Flight," and many other air and action pictures. Last summer he and Elmer Dyer were busy putting "West Point of the Air" in the box when he came rather close to being put in a box himself. He and Lt. George Hansen, O.C. 20th Photo Section, Air Corps, were making a shot for the opening scene of the Randolph Field sequence. The action called for the camera ship to make a shallow dive toward the Administration Bldg., from about 4,500 feet. During their dive a low-flying 48-plane formation was to pass through the picture, and when the formation was clear, Marshall and Hansen were to go into a steep dive toward the big concrete sign, "Randolph Field," just in front of the building, and then zoom over the tower. Hansen apparently dived steeply too soon, so that he was blind to the formation and the formation was blind to him. Instead of clearing the last section, he flew right through it, missing the lead ship by a yard and actually blowing it 150 feet up out of the formation! This incident in the day's work serves to explain why aerial camera experts seldom are troubled by torpid livers.

Charley is a real Native Son, which classes the same as being a Daughter of the American Revolution in Boston, the world's most backward big village.

Charles Marshall was born in Los Angeles, July 21, 1898, ambling casually through the Los Angeles Public Schools and the Hollywood High School until 1916, when he fell victim to a perfect frenzy for knowledge and work, absorbing great chunks of higher education in Hollywood Junior College and working nights as a negative film developer at the old Lasky Studio laboratory. After going to college all day he'd grab a cat-nap in the late afternoon, then go to the Lab and work all night developing film, grab another modicum of sleep between 6 and 7 a.m., and be lapping at the fount of learning by 8. How he stood it, I don't know.

Charlie Marshall

The war rescued him from this orgy of industriousness, and in the Spring of 1917 he enlisted in the Air Service, went to the Signal Corps Ground School, and was ground out ready for flight training at March Field in five months. Here he made the awful mistake of learning too well and becoming too good, with the inevitable result that when he finished his primary training and was commissioned a 2nd Loot, was given a few weeks advanced instruction at Rockwell Field, San Diego, and promptly sent back to March Field as an instructor—thus missing the War, for the Armistice found him still instructing in flying and swearing, which subjects were taught together in those happy care-free days. Only recently I met one of my own former R.F.C. students, and he told me that he has always been grateful to me for the words I taught him back in 1918. He is a stock broker, and he has used them many times during the period from 1929 to 1934, until he finally got too weak from starvation even to swear. That's one thing I'm really grateful to President Roosevelt for—he's made the brokers as poor as their clients.

After the United States had finished making a sucker of itself in the war, Lieut. Marshall was chucked out of the Air Corps and returned to the ranks of Hollywood, where he became a private in the great movie industrial amusement army. Marshall went through the mill, from negative developing to printing, taking in stride that truly horrible phase of cinema development known, I believe, as toning and tinting the prints. Do you remember that ghastly period when green movie actors and actresses would suddenly and surprisingly turn brown, or blue, or sepia? Charley was the boy who achieved those grisly effects by the unrestrained use of various chemicals. At that time he was known as Chief Color Chemist, but nobody shot him. Repenting at last, he fled the laboratory and became an assistant cameraman, specializing in the use of the camera developed by the late Carl Akeley for getting candid camera studies of the gorilla at play, and quick-action shots of lions being perforated by Masai assegais. It was this Akeley invention that raised Mr. and Mrs. Martin Johnson from obscurity and brought Africa and its animals and Hottentots to Sauk Center and other rural retreats. It also afforded Charles Marshall his opportunity to become an ace cinematographer of the air. As an Akeley specialist he shot parts of "Ben-Hur," "The Big Parade," and many other films in need of action-camera work, thus gradually working toward aerial sequences in "Hell Divers" and the other good action pictures that I have mentioned.

Aside from his flying in picture work, Charley has kept up his own flying with the 478th Pursuit Squadron, A. C. Reserve, first at Clover Field and now at Long Beach. For the past 15 years he has held a 2nd Lieutenant's commission in the reserve, flying as regularly as his film work would permit. He put in quite a lot of time at Randolph, flying both dual and solo, while he was filming "West Point of the Air"—which will probably (title experts being what they are) be released as "Hot Cadets."

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T. M. (Tough Moose) "Pat" Reid

● T. M. "PAT" REID has probably flown over more territory than has any other pilot in the second largest country in the world. What is the second largest country in the world? And what is the largest? Which is the dumbest? No, it isn't the District of Columbia—that isn't a country—it's a free-feed sanctuary for Democrats. The largest country in the world is Russia, with 8,660,000 square miles and 567,987 bushels of uncut and unfumigated whiskers; and the second largest country is Canada, with a coastline more than 18,000 miles long and an area of 3,690,643 square miles. It is inhabited by Canadians, moose, deer, squirrels, chipmunks, and American tourists—named in the order of their importance and popularity. Canada was discovered by an American explorer back in 1920, D.P. (During Prohibition). Before that year Americans had always thought of Canada as a suburb of the North Pole, but when the Great Drought hit our land of the Free, a few hardy spirits went adventuring Northward looking for a country that never boasted about its Freedom, because it always had it, except on Sunday, when a group of fanatics and crack-pots known as the Lord's Day Alliance and other names take Canada over and make it like Philadelphia. Well, these hardy American explorers discovered Montreal and Toronto, and brought back great tales about Canada—one of them told how he had shot a moose on the second floor of T. Eaton & Co. in Toronto, and we were about to give him the Congressional Medal when it was learned that it was a stuffed moose. So we gave the medal to Admiral Byrd, instead.

Anyhow, Pat Reid is probably the most famous aerial rambler in Canada, and if you draw lines over a map of Canada showing his flying trips it will be as criss-crossed as a railroad map of the state of Ohio. He has taken it all in numerous times, from Sydney, Nova Scotia, to Victoria, British Columbia, and from Windsor, Ontario, on the south to Coronation Gulf on the north side of Canada. He commutes to places like Buffalo, Cleveland, Chicago, and Minneapolis to study the wild life of those parts, and has flown in Alaska and Siberia to cool off. He is Aviation Representative of Imperial Oil Limited, and goes around dressed in the hides of wild animals, as his picture clearly shows. He shot that coat, by the way, on the outskirts of Toronto, believing that the animal wearing it at the moment was an Elk—but it turned out to be a member of the Toronto Lions' Club coming home from a luncheon. Pat apologized to the widow, but she thanked him with a charming smile, remarking that she was tired of that Lion anyhow and had been considering trading him in for a Rotarian.

Pat Reid was born on a farm in Ballyroney, County Down, Ireland, forty years ago and educated until he was smart enough to get out of Ireland. He learned enough about farming in Ireland to realize that it was no profession for a young man who enjoyed sitting down; in fact, the reason he finally selected piloting was because he could work at it while seated. This is the soundest reason I've yet heard for a fellow becoming a pilot. On the farm, Pat tells me, he did a good job looking after the pigs, and adds, "don't forget to mention the pigs as I shouldn't like their descendants to think I was high-hatting them." He states that for the first couple of days after the little pigs are born the pig-herder has to watch constantly to see that the old sow doesn't carelessly roll over on them, like the Democratic political machine squashing a Republican Congressman. It was young Pat's duty to nudge the sow occasionally and say, "Roll over—you're on Mike and Roscoe." From such humble beginnings do great men spring.

After his course in pig raising Pat took aboard a mixed cargo of French and Latin and other impedimenta of the higher learning, but quit after two years of it to serve a six-year apprenticeship as an automobile engineer. He got through three years and in April, 1915, joined the Royal Naval Air Service as an "air mechanic first class," which meant that he was issued one blanket and one shilling more than the air mechanic second class. Six weeks later he was in the thick of the Dardanelles campaign, then in Salonica, and home in 1917 as a confirmed malaria addict. Then he joined the North Sea patrol, flying as engineer and observer and getting flying instruction. He won the Distinguished Service Medal when the pilot was killed by the enemy and the boat was forced down on the sea with a broken gas line. He made repairs and flew the boat home. He was ten months at Dunkirk, France, and finished the war at Felixtowe, England, after service as observer, gun-layer, and second pilot. He was with Handley Page Transport flying between London and Paris on the first cross-channel service, also to Brussels and Amsterdam.

In 1924 he came to Canada, joined the Ontario Provincial Air Service and for three years flew forestry patrols as air engineer and pilot. He joined Northern Aerial Mineral Exploration in 1927 and in 1929 made the first flights around Hudson's Bay and into the Arctic regions, from Wager Inlet to Coronation Gulf, Ft. Hearne, Ft. Norman, Great Bear Lake, Great Slave Lake, and other places that will remain only names to most of this generation. It is a country rich in timber, fur, and minerals, and some day there will be cities in those places where to-day only aerial explorers like Pat Reid and men on snow-shoes have penetrated. At 50 below Zero, Pat is welcome to all the timber, fur, and minerals he can find—I hope to be in Florida, with the bathing beauties.

In the winter of 1929 Pat Reid took charge of the Eilson Relief Expedition to Siberia. But starting from Fairbanks, Alaska, he had the bad fortune to be forced down by a snowstorm in the mountains between the Yukon River and Nome, landing in a creek bed and damaging a wing. He was missing for a week, and upon his return read his own obituary notice in the papers. Meanwhile several Russian and two Alaskan pilots, Joe Crosson and Harold Gillam, continued the search. They found and brought the bodies of Eilson and Borland back to Alaska.

Reid spent a short time with Fairchild Aircraft Ltd., as sales representative and then joined Imperial Oil as Aviation Representative in 1931. He led the Trans-Canada Air Pageant in 1931, the Manitoba Good Will Air Tours of 1932 and 1933, and the St. Lawrence Air Cruise of 1934. But it is not for these achievements that I shall remember Pat Reid. On a Canadian Sunday in Toronto, when everything is shut up tight, Pat got me some bottled ale. Even the gruesome Lord's Day Alliance can't keep a good Irishman down.

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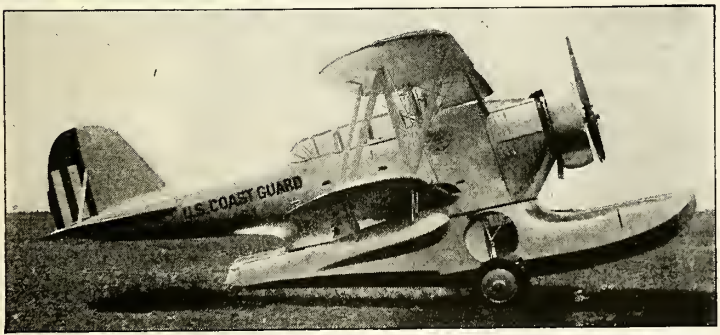

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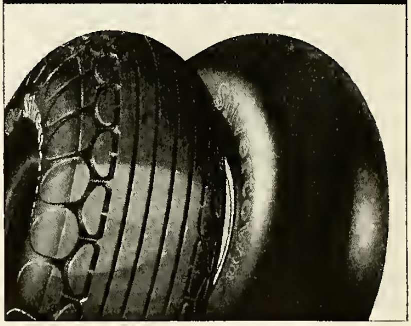

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A Theoretical Determination of the Effect of Trailing Edge Tabs

GEORGE A. ALLWARD

From 1920 to 1929 Mr. Allward was connected with Geo. Parnall & Co., Bristol, England. During this period some 20 different types of aircraft were designed and constructed in which he took an active part as an assistant engineer. The most renowned ship was probably the Parnall "Pete" which was used in conjunction with the submarine M2. He came to America in 1929 and joined Crouch & Bolas at Providence, R.I. As assistant chief engineer, he designed and supervised construction of the "Dragonfly" (noteworthy for its slow speed characteristics) and assisted in the design and development of two 4-cylinder inverted air-cooled engines. He cooperated with Mr. Bolas in the publication of many technical papers, among them being: "Loads on the main planes and tail of an airplane when recovering from a dive," published as an R. & M. by the N.A.C.A. in 1929. At present he is connected with the engineering staff of Fairchild Aircraft Corp. (formerly Kreider-Reisner Aircraft Co.)

● The use of trailing edge tabs as a means of trimming and balancing control surfaces is rapidly becoming popular and the author has endeavored in this article to develop a rational theory with a general application to any type of control surface.

By making certain assumptions (which are discussed later) it is possible, knowing the geometrical and aerodynamic constants for the surface under consideration to calculate values of control surface angle, tab angle and tab loading for any given flight condition. Hence in the case of longitudinal control, it is possible to determine the range of elevator and tab angles required to trim the ship throughout all conditions of steady flight.

Application of the theory to servo control tabs shows a remarkably good agreement with the wind tunnel results.[1]

In the case of the unbalanced flap the theory appears to give good results for flap angles up to 10° while in the case of the balanced type close agreement is established up to angles approaching 20°.

The effect of tab aspect ratio and area has been studied the results being presented and discussed later.

Nomenclature

V,	Air speed (ft. per sec.)
δ_1,	Tail Area unaffected by tab (sq. ft.)
δ_2,	Tail Area affected by tab (sq. ft.)
α,	Angle of fixed tail to relative wind (degrees)
η,	Angle of elevator to fixed tail (degrees)
λ,	Angle of tab to elevator (degrees)
Ψ,	Angle of equivalent chord to relative wind (degrees)
Φ,	Angle of no lift of stabilizer plus elevator (degrees)
C,	Total mean chord (ft.)
f_1,	Elevator chord rearward of hinge as proportion of total chord
f_2,	Tab chord as proportion of total chord

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[1] *Servo Control Flaps* by Professor Reid, Stanford University; Oct. 1934, *Journal of Aeronautical Sciences.*

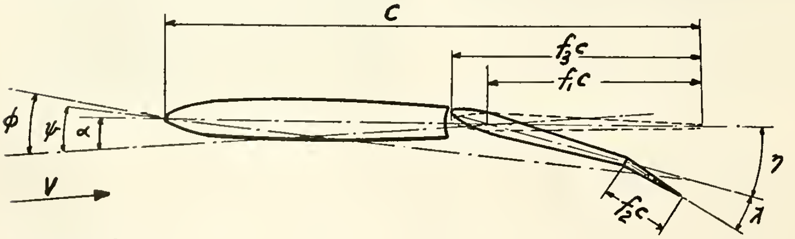
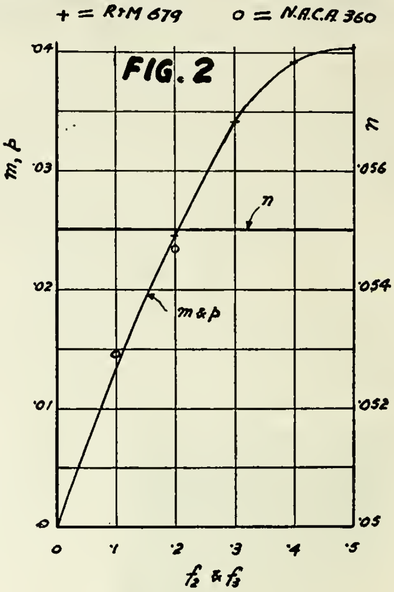


FIG. 1



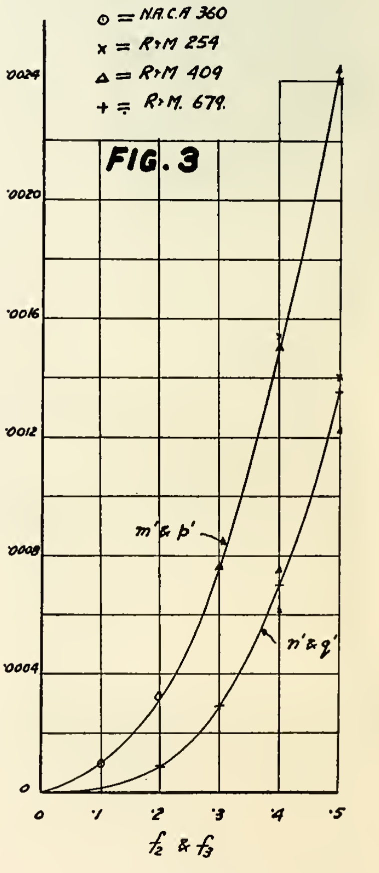
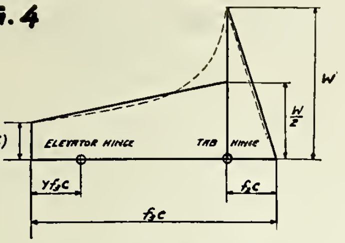


FIG. 4



f_3, Elevator chord as proportion of total chord

μ, Position of tab C.P. from its hinge as proportion of its chord

k, Coefficient of elevator hinge moment dependent upon location of hinge

$n = dC_L/d\propto$; $m^1 = dC_H/d\eta$; $q = dC_L/d\Phi$; $p = dC_L/d\lambda$;

$m = dC_L/d\eta$; $n^1 = dC_H/d\propto$; $q^1 = dC_H/d\Phi$; $p^1 = dC_H/d\lambda$

For all practical purposes in considering the portion of tail unaffected by tab, the lift coefficient may be expressed as a function of fixed tail and elevator angles

thus $C_{L1} = (n\propto + m\eta)$

Lift in lbs. $P_1 = \rho/2g\ \delta_1\ V^2\ (n\propto + m\eta)$ ....(1)

Similarly

$$C_{H1} = (n^1\propto + km^1\eta)$$

Hinge moment in lbs./ft. $H_1 = \rho/2g\ \delta_1\ V^2c\ (n^1\propto + km^1\eta)$............(2)

Portion of Tail Affected by Tab

The assumption made here is that the stabilizer with its elevator deflected $\eta°$ may be treated as a fixed airfoil having an angle of attack $\Psi°$ or $\Phi°$ from no lift. There is also a reduction in effective chord but for small displacements of elevator this may be neglected.

This assumption is probably justified provided the gap between elevator and stabilizer is small and the aerodynamic balance does not become unshielded.

We may write

$C_{L2} = [q\Phi + p(\lambda + \propto + \eta - \Phi)]$

but $\Phi = \propto + m/n.\ \eta$

so that $C_{L2} =$

$$[q\ (\propto + m/n.\eta) + p\ [\lambda + \eta\ (1 - m/n)\ ]\ ]\text{..............}(3)$$

For $\lambda = 0$ $C_{L2} = (n\propto + m\eta)$

thus

$$q = \frac{(n\propto + m\eta) - p\eta(1 - m/n)}{(\propto + m/n.\eta)}\qquad(4)$$

Substituting (4) in (3) we obtain

$$C_{L2} = (n\propto + m\eta + p\lambda)\text{......}(5)$$

Lift in pounds

$P_2 = \rho/2g\ \delta_2\ V^2\ (n\propto + \mathrm{m}\eta + p\lambda)$ (6)

Tab hinge moment about its own hinge

$C_{HT} = [q^1\ (\propto + m/n.\eta) + p^1\ [\lambda + \eta\ (1 - m/n)]\ ]$

$H = \rho/2g\ \delta_2\ V^2c\ [q^1\ (\propto + m/n.\eta) + p^1\ [\lambda + \eta\ (1 - m/n)\ ]\ ]$

Tab lift in pounds

$P_3 = \rho/2g\ \delta_2\ \mathrm{V}^2\ [q^1\ (\propto + m/n.\eta) + p^1\ [\lambda + \eta\ (1 - m/n)\ ]\ ]/\mu f_2$..........(7)

Hinge moment of portion affected by tab about elevator hinge

$= H_2 = \rho/2g\ \delta_2\ V^2c\ (n^1\propto + km^1\eta + r\lambda)$ ....(8)

Combining the two portions of the tail surface

$$P_1 + P_2 = P\ \text{(total lift)}$$

$P = \rho/2g\ \delta_1\ V^2\ (n\propto + m\eta) + \rho/2g\ \delta_2\ V^2\ (n\propto + m\eta + p\lambda)$

since $\delta_1 + \delta_2 = \delta$

we may write

$P = \rho/2g\ \delta\ V^2\ (n\propto + m\eta + \delta_2\ p\lambda/\delta)$ ....(9)

or $C_L = (n\propto + m\eta + \delta_2\ p\ \lambda/\delta)$..(10)

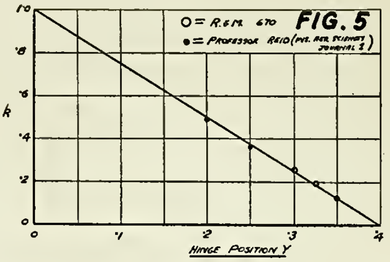
Similarly

$$H_1 + H_2 = H\ \text{(total hinge moment)}$$

$H = \rho/2g\ \delta\ V^2c\ (n^1\propto + km^1\eta + \delta_2\ r\lambda/\delta)$ ....(11)

or $C_H = (n^1\propto + km^1\eta + \delta_2\ r\lambda/\delta)$.(12)

Since for trimmed conditions hinge moment must equal 0 we may equate (12) to 0 and solve for λ



$$n^1\propto + km^1\eta + \delta_2\ r\lambda/\delta = 0$$

$$\therefore \lambda = -\ \delta/\delta_2 r\ (n^1\propto + km^1\eta)\text{..}(13)$$

Substituting (13) in (10) we obtain

$C_L = [n\propto + m\eta - p/r\ (n^1\propto + km^1\eta)\ ]$ ....(14)

By assigning appropriate values of n, m, p, r, n^1, m^1, k $\propto$ and C_L in equation (14) a solution is obtained for η. A further substitution in equation (13) determines the value of λ, and the tab lift is obtained by substitution in equation (7).

Values of lift and hinge moment coefficients corrected for a tail aspect ratio of 3.5 are given in figures 2 and 3. An aspect ratio of 3.5 was chosen as representing the average tail geometry. When using figure 2 to determine the value of m for balanced elevators of the set-back hinge type, only that portion of the elevator chord rearward of the hinge may be taken as being effective. This assumption is logical if the aerodynamic balance does not become unshielded and is substantiated by wind tunnel tests.[2]

The value of k, a coefficient of hinge moment dependent upon the location of the hinge from the leading edge of the control surface, may be obtained from figure 5.

In the determination of r (hinge moment coefficient of tab about elevator hinge), it appears from pressure plottings[3] that the form of the distribution over the rear portion of the airfoil remains the same for tab angles up to 20°.

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[2] Lift, Drag and Elevator hinge moments of Handley Page control surfaces. N.A.C.A. 278.

[3] Pressure distribution over a symmetrical airfoil section with trailing edge flap. N.A.C.A. 360.

FIG. 6

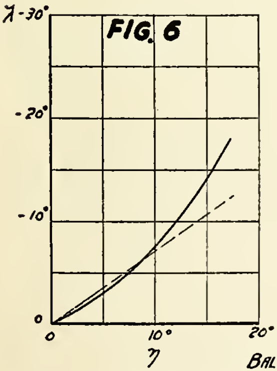
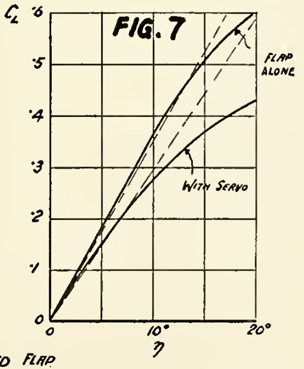


FIG. 7



BALANCED FLAP

FIG. 8

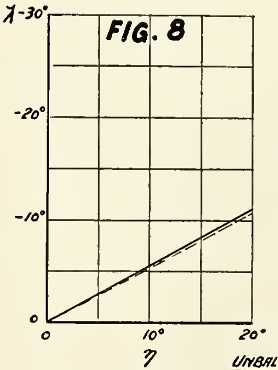
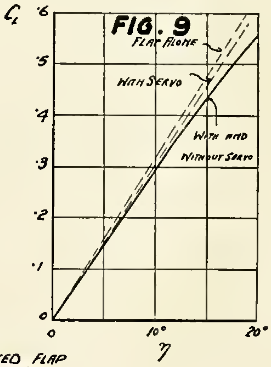


FIG. 9



UNBALANCED FLAP

In the above graphs the theoretical results are indicated by broken lines and the test results by full lines

The actual pressure plottings for a tab angle of 10° and a fixed surface angle of zero are shown in figure 4 together with an approximation to the form of distribution used in the following calculation for r (figure 4).

By expressing w (figure 4) in terms of the tab hinge moment coefficient p^1 about its own hinge and taking moments about the elevator hinge:

$$r = \frac{6p^1}{f_2^2}\left[\frac{f_2}{2}\left(f_3 - \frac{2}{3}f_2\right) + \frac{(f_3 - f_2)^3}{9.6} + \frac{(f_3 - f_2)^2}{6} - Y f_3 \left(\frac{f_3 - f_2}{4} + \frac{(f_3 - f_2)^2}{3.2}\right)\right]$$

Numerical values for r have been omitted since the expression contains many variables. Its value for any particular case however can be obtained from the above equation.

The aspect ratio correction formula used throughout is:

$$M_e = m/[1 + 57.3/\pi . m\ (1/A_w - 1/A_T)]$$

where $m = dC_L/d\alpha$ for aspect ratio A_T

$m_e = dC_L/d\alpha$ for aspect ratio A_w

Tabs present an excellent means of trimming and balancing control surfaces, but they do entail a loss of efficiency and reduce the effective control range. This detrimental effect is inherent and while it cannot be eliminated entirely it is possible to reduce it to a negligible amount by correct proportioning of surfaces.

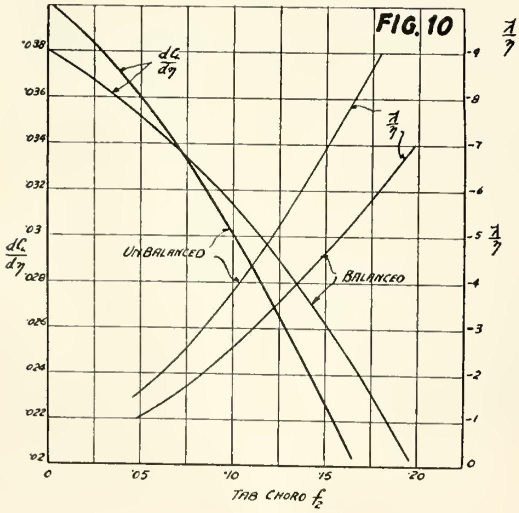
It is obviously desirable to use the most efficient elevator and from figure 2 a chord of 40% in the case of the unbalanced type and about 50% when balanced would be indicated.

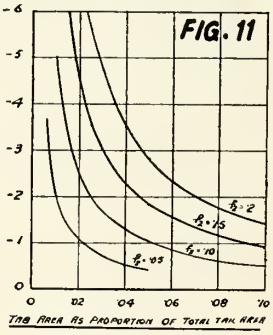
Since for trimmed conditions of the elevator, the lift coefficient appears to be dependent solely upon the tab chord irrespective of its area (figure 10) it is advisable to use the smallest chord consistent with practical considerations.

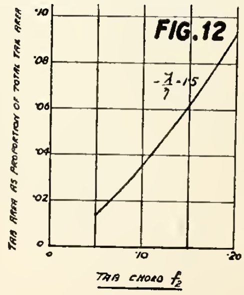
The tab area is determined by its permissible angular travel, which should probably not be allowed to exceed 25°. The necessary areas required for a 50% elevator balanced at 25% of its chord to give a tab displacement of 1½ times the elevator angle are shown in figure 12. This would correspond to a tab angle of about 25° when trimmed for the glide, assuming 50% elevator travel left for control.

The unbalanced elevator appears to give a higher efficiency for very small tab chords but rapidly becomes inferior to the balanced for values higher than .075 (figure 10). For the same angular displacement of tab (.05 to .10 chords) the unbalanced elevator requires 50% more tab area than the balanced. It is advantageous therefore to use the balanced type of elevator since the difference in C_L is small for the range of tab chords used in practice.

To determine the tab proportions to trim aircraft (a) determine minimum speed at which it is desirable to trim the aircraft (normally about 30% in excess of stalling speed); (b) determine C_L necessary for equilibrium at this speed; (c) calculate downwash angle at the tail under these conditions; (d) choose the smallest practicable tab chord and from the geometrical and aerodynamic constants evaluate the required tab area; (d) using the deduced tab geometry repeat the calculations for the high speed condition and thus determine the necessary angular range required to trim the aircraft throughout the speed range.







Aeronautical Patents

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Controlling apparatus for aircraft. Waldemar Moller, Klein-Machnow, Germany. (1,986,761)

Gyroscope and gyroscope compass. Reginald E. Gillmor, Stamford, Conn. (1,986,807)

Airplane propeller. Robert L. Walsh, Dayton, Ohio. (1,986,867)

Apparatus for sky writing. John T. Remey, New York, N. Y. (1,986,942)

Retractable landing gear for airplanes. Vincent J. Burnelli, New York, N. Y., assignor to Burnelli Aircraft, Ltd., Dover, Del. (1,987,049)

Tailless airplane. Vincent J. Burnelli, assignor to Burnelli Aircraft, Ltd. (1,987,050)

Gyroscopic position indicator. Leslie R. McDonald, Montreal, P.Q., Canada. (1,987,483)

Altimeter. Frederick H. Drake, Boonton, N. J., assignor to Radio Corp. of America. (1,987,588)

Combined front and rear propelling and steering mechanism for aircraft, and hovering airplane mechanism. Robert W. Davis, Milwaukee, Wis. (1,987,606 and 1,987,607)

Aircraft propellers. Albert P. Wiegand, Pittsburgh, Pa. (1,987,650 and 1,987,651)

Pressure regulating means for aircraft instruments. Bert G. Carlson, Queens Village, N. Y., assignor to Sperry Gyroscope Co. (1,987,666)

Aeronautical propeller. Heinrich Sukohl and Ludwig Hoffmann, Germany. (1,987,760)

Aircraft. Benjamin A. Morton, N. Y. (1,987,788)

Airplane wing. Knut Henrichsen, Hartford, Conn., assignor to Curtiss-Wright Airplane Co. (1,988,079)

Landing gear. Colby W. Steward, Buffalo, N. Y., assignor to Curtiss Aeroplane & Motor Co. (1,988,093)

Aileron and flap combination. Frederick R. Weymouth, Buffalo, N. Y., assignor to Curtiss Aeroplane & Motor Co. (1,988,148)

Hangar. Charles J. Carlotti, New York, N. Y. (1,988,187)

Hollow propeller. Walter S. Hoover, Girard, Pa. (1,988,202)

Airship. William Noelle, Chicago, Ill. (1,988,328)

Airplane altitude indicator. Carl Schenk, Los Angeles, Calif. (1,988,463)

Gyro earth inductor compass. Elmer A. Sperry, Jr., Brooklyn, N. Y., and Bruno A. Wittkuhns, Chatham, N. J., assignors to Sperry Gyroscope Co. (1,988,521)

Captive balloon. Jean Letourneur, Versailles, France. (1,988,562)

Wing construction. Edward A. Stalker, Ann Arbor, Mich. (1,988,670)

Aircraft having rotative sustaining means. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (1,988,836)

Seaplane float. Adolf Beck, Bitterfeld, Germany. (1,988,863)

Pack for parachutes. Samuel H. Knight, Lancaster, Pa. (1,988,872)

Flying machine with beating and sliding horizontal louver-like wings rotating in opposite directions. Giuseppe A. Prosdocimi, Bologna, Italy. (1,988,916)

Airplane and helicopter. Antonio V. Santarsiero, New York, N. Y. (1,988,919)

Wind direction indicating airways beacon. Dudley B. Howard, Washington, D. C. (1,989,095)

Airplane. Richard M. Prewitt, East Hartford, Conn. (1,989,291)

Landing signal. Arthur T. Sewell, Edwardsville, Kans. (1,989,295)

Airplane. Roy E. Guthier, Chicago, Ill. (1,989,358)

Airplane construction. Halbert H. Holloway, Los Angeles, Calif. (1,989,450)

Aircraft of the rotative sustaining-blade type. Harris S. Campbell, Hatboro, Pa., assignor to Autogiro Co. (1,989,544)

Vertically-reciprocating winged aviating apparatus for human beings. Martin Jelalian, New York, N. Y. (1,989,755)

Airplane turn and bank indicator and artificial horizon. Carl Schenk, Los Angeles, Cal. (1,989,826)

Airplane brake. Earl J. W. Ragsdale, Norristown, Pa., and Robert B. Temple, Detroit, Mich., assignors to Budd Wheel Co., Philadelphia, Pa. (1,990,252)

Aircraft. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (1,990,269)

Air rotor for aircraft. Agnew E. Larsen, Huntington Valley, Pa., assignor to Autogiro Co. (1,990,291)

Airplane. Byron B. Phillips, Stuyvesant Falls, N. Y. (1,990,308)

Propelling mechanism for aircraft and like. Ludwig Netter, Otterstadt, Germany (1,990,462)

Braking mechanism. Malcolm Loughead, Los Angeles, Calif., and Wallace F. Oliver, Detroit, Mich., assignors to Hydraulic Brake Co., Los Angeles, Calif. (1,990,493)

System of making observations and directing gun fire (from aircraft). William H. Murphy, Washington, D. C. (1,990,494)

High Octane Fuel Tests

WM. R. HOPKINS, M.E.

● The U. S. Army Air Corps has for some time considered the possibilities of fuels with a higher knock rating than the present Air Corps standard fighting fuel of 92 octane number as determined by the C.F.R. knock test engine (87 octane number as previously determined and as commercially rated). S. D. Heron, formerly in charge of fuel research at the Materiel Division, Wright Field, Dayton, Ohio, and Lieutenant F. D. Klein, now in charge of fuel research at the Division, were instrumental in fostering the development and testing of the fuels reported in this article.

Five fuels were tested including the present standard Air Corps aviation gasoline, conforming to U. S. Army Specification Y-3557-G, 92 octane number, Aviation Fighting Grade, Anti-Knock. (Similar to a high grade, commercial aviation gasoline of 87 octane number, it generally contains 1 to 4 cc of lead per gallon).

The others were: #530, 100 octane number, 50% commercial iso-octane plus 50% good quality aviation gasoline plus 3 cc of lead per gallon; #531, 100+ octane number, is the same as #530 except that it has 6 cc of lead per gallon instead of 3 cc per gallon; #532, 100 octane number, is the standard reference fuel C-6 plus 8.5 cc of lead per gallon; and #533, 100 octane number, which contains 25% commercial iso-pentane plus 37.5% commercial iso-octane plus 37.5% highly aromatic fuel plus 1 cc of lead per gallon.

The P. & W. Wasp engine used in testing fuels is similar to the standard commercial engine rated at 500 h.p. at sea level at 2200 r.p.m., and was not modified except that iron-constantan thermocouples were imbedded in the heads and barrels of all cylinders. The impeller tip speed at 2200 r.p.m. crankshaft speed is 925 feet per second. The engine has a 6:1 compression ratio, 14:1 impeller ratio, and a 6⅞″ impeller diameter.

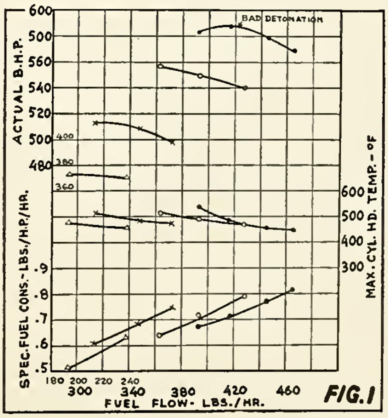


FIG. I

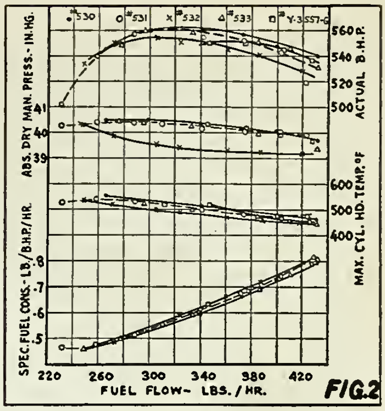


FIG. 2

The Wright Cyclone engine is similar to the commercial engine rated at 700 h.p. at sea level at 1950 r.p.m. It, also, had thermocouples imbedded in all heads and barrels and was equipped with 10:1 ratio supercharger impeller gears, which is a higher ratio than is furnished as standard on any commercial Cyclone. The impeller tip speed at 1950 r.p.m. crankshaft speed is 935 feet per second. This engine has a compression ratio of 6.4:1, and an 11″ impeller diameter.

All runs were made on a dynamometer, the power being absorbed by an electric cradle dynamometer and water brake. The engines were cooled by an air blast closely confined to the engines. The air blast temperature averaged 85° F. while testing the Wasp and 70° F while testing the Cyclone. The static pressure of the air supply was maintained at 14″ of water while testing the Wasp engine. The blast on the Cyclone was reduced in order to more quickly determine, by cylinder temperature rise, any detonation encountered. The static pressure of the air supply was maintained at 11″ of water.

Figure 1 (constant throttle mixture control runs at 2200 r.p.m.) shows curves obtained with the Wasp engine using standard fuel Y-3557-G at various throttle settings. Each curve was obtained with the throttle set and the mixture control changed to reduce the fuel flow from point to point. The leanest curve was plotted to the scales shown in small figures in order to have all the curves on one sheet. These curves show the tendency of the cylinder temperatures to rise with lean mixtures at any power output.

Figure 2 shows the results of constant throttle, constant speed, mixture control runs, made with the Wasp engine turning 2200 r.p.m., and using the five different fuels. Fuel Y-3557-G appears inferior to the others, but the relative difference is not clearly shown. The manifold pressure curve for fuel #532 is in error as subsequent runs showed no marked difference from the other 100 octane fuels.

Figure 3 shows the results obtained with the Wasp engine, at constant speed, using the five different fuels. For this and succeeding runs, the carburetor economizer jets were blanks so that the specific fuel consumption remained almost constant throughout the throttle opening range used. In making these runs, the speed was maintained constant and the throttle was opened from point to point until one or more cylinder heads showed excessive (550° F) temperature. In the case of fuel Y-3557-G, one cylinder would become excessively hot before the average temperature showed a very great rise.

Figure 4 shows the results of runs similar to those shown by figure 3 except that only three fuels were used and tests were run at three different specific fuel consumptions. In all cases with the 100 octane fuels, it was possible to reach a full throttle position during the runs shown on figure 4.

During all runs with the Wasp engine, the operation was satisfactory.

Figure 5 shows the results of the runs made on the Cyclone engine. For these runs, also, the carburetor economizer jets were blanks and the specific fuel consumption was approximately constant, the increase in power being obtained by opening the throttle from point to point. With fuel Y-3557-G, the maximum throttle opening was limited by the engine "cutting out" at a greater throttle opening. This was apparently due to incipient detonation as the exhaust flames indicated detonation, although it was impossible to run long enough to obtain an excessive cylinder head temperature rise. The shape of the curve with Y-3557-G fuel indicates that excessive temperatures would soon have been reached if operation could have been continued.

The curves show an increase in horsepower with 100 octane fuel over 92 octane fuel of 14% to 22% in the Wasp engine, and of 24% to 31% in the Cyclone engine. The greater increase observed in the Cyclone engine was due to the greater supercharger and compression ratios which made it possible to take more advantage of the higher anti-knock properties of the fuel.

Little difference could be determined between any two of the 100 octane fuels, which indicates that the increased performance was due to the higher anti-knock properties of the fuel, and that the C.F.R. knock test engine results check rather closely multi-cylinder engine results. Fuel #533 appears slightly inferior to the other 100 octane fuels in all curves and in the Cyclone engine (figure 5) its octane number would be approximately 98 in comparison to the other 100 octane fuels.

The increase in engine performance, shown possible by these tests when using fuels of higher than usual anti-knock values, could be utilized to a greater degree in an engine designed for these fuels. A higher compression ratio would make possible greater power and better fuel economy in an engine of given size and weight. A higher supercharge could be used to increase altitude performance and increase the sea level boost for take-off and climb. Intercoolers would be necessary for efficient operation with high supercharge, as the heating of the air through the supercharger had the effect of reducing the anti-knock value of the fuel. However, with engines designed for operation at high altitudes where the air is very cold, a high anti-knock fuel would make possible satisfactory operation near the ground on take-off and climb. It has been determined that each octane number increase in fuel anti-knock value decreases the cylinder head temperatures 11° F to 18° F in air-cooled engines operating near the detonation range.

The following flight test data were obtained from Lieutenant F. D. Klein's report presented before the Institute of the Aeronautical Sciences on January 30, 1935:

"Several pursuit planes undergoing performance tests at Wright Field recently had encountered difficulties, the engines overheating when operated on Specification Y-3557-G fuel. In one case it was essential to determine high speed on the speed course, and full throttle operation was made possible by the use of 100 octane fuel. In another case, overheating was experienced in checking the rate of climb, but by substituting 100 octane fuel, the cylinder head temperatures dropped about 30° C, making it possible to complete the tests without exceeding the maximum allowable cylinder temperature.

"In the Mitchel Trophy Race, held at Selfridge Field, in November, 1934, ten P-26A airplanes competed over a closed five-mile course, the race being five laps. These airplanes were equipped with high-output engines which could not be opened fully near the ground. To make possible an increase in the power output, and thereby raise the speed of the race, 100 octane fuel was used. This permitted the airplanes to operate with a reasonable margin of safety at considerably higher speed than was possible on the original performance test on a straight course at sea level using Specification Y-3557-G fuel, and no detonation was evident to the pilots. The race was won at 216.8 m.p.h. This speed is low compared with that of racing planes, because this race is limited to standard service type pursuit planes. In a different race on the same day a similar P-26A low-wing, all-metal airplane averaged considerably higher speed over a straight mile course."

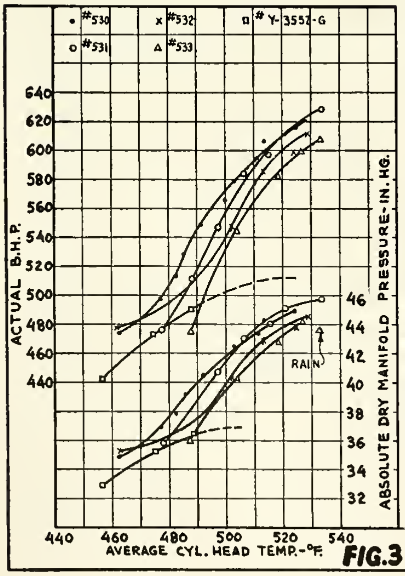


FIG.3

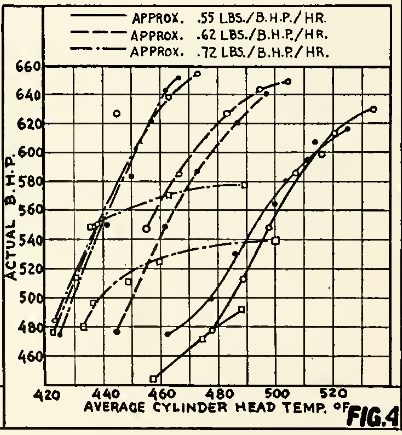


FIG.4

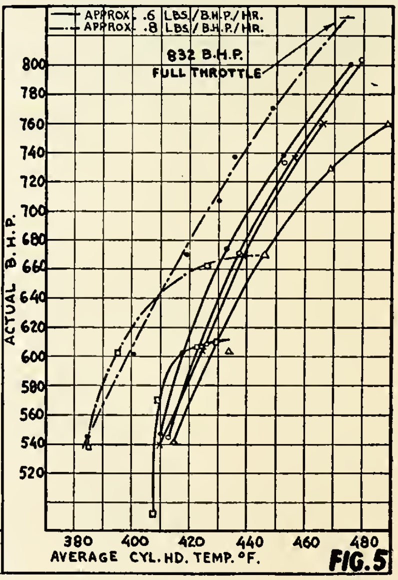


FIG.5

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Will Future Aircraft be Diesel-Powered?

●

GLENN D. ANGLE

● Engineering achievements of the past decade clearly indicate that forecasting future developments in any field of modern transportation is a grave undertaking. The question introduced by the title of this discussion contains no promise that a serious attempt to determine the final answer will be presented. Rather, it is intended to deal with the pros and cons on the subject, briefly treat the developments in the Diesel type aircraft engine to date, and let the reader draw his own conclusions.

Some engineers, who undoubtedly appreciate the problems involved, lean toward the view that the Diesel engine is inherently unsuited for aircraft, and its development must reach a more advanced stage before satisfactory types will come into regular use. The average person with little or no technical training or experience, who observes the steady increase in the number of Diesel engines employed in various other fields of power development, opines that it is only a matter of a comparatively short time before all aircraft will be Diesel engine powered. Since it is often a well-proportioned mixture of engineering and public opinion that produces the best result, it seems rather appropriate at this time to briefly discuss matters of major importance which have some bearing on the subject.

Before we take up the technical aspects of this discussion, let us survey the several conversions and new designs of Diesel type engines built especially for aircraft propulsion. This list may not be complete, but it is believed that all models described in the technical press are included. First, it must be explained that the term Diesel is not employed in the broader sense of its misuse, but only to classify both two and four-cycle engines of the compression-ignition type.

The accompanying table, which lists the principal known characteristics of all aircraft engines of the Diesel variety, should aid our examination since the arrangement permits ready determination of other type classifications. In all, there are 35 models listed. While not especially significant, it is interesting that this number is less than two per cent of the total number of aircraft engine models constructed for all time. At least five are known to be conversions, and the Renault, Lorraine and Bristol designs of the radial air-cooled type might be considered in the same light since they so closely resemble the design of other engines in this classification built by these firms. Among these models, there is some duplication of types as a result of license agreements, such as Compagnie Lilloise de Moteurs and Napier which are licensed to build the Junkers design; Panhard builds under Clerget license, and the Walter is a duplication of the Packard Diesel. This brings us even closer to the conclusion that the Diesel type aircraft engine has received little attention.

		Country	Manufacturer	Model	Rated H.P.	R.P.M.	Wt./H.P.	H.P./cu.in. displ.	No. of cyls.	Arrangement
FOUR CYCLE	LIQUID-COOLED	United States	Allison	Navy	900	1200			6	In Line
		Great Britain	Beardmore	Tornado	585	900	7.17	.114	8	In Line
		Italy	Fiat	(*)	180	1600		.117	6	In Line
		Italy	Isotta-Fraschini	(*)						
		France	Jalbert		180	1930		.233	6	In Line
		Germany	M. A. N.		1000					
		Germany	Maybach		150	1300	17.00		6	In Line
		Germany	Mercedes	F-2 (*)	700	1675	2.78	.212	12	Vee
		Great Britain	Rolls-Royce	Condor (*)	480	1900	3.00	.224	12	Vee
		France	Salmson	Szydlowski (L)	600	1600		.333	9	Radial
		Great Britain	Sunbeam	P-1	100	1500		.186	6	
	AIR-COOLED	United States	Av. D. Eng. Co.		400	1500		.212	7	Radial
		Great Britain	Bristol	Phoenix	350	1900	2.83		9	Radial
		France	Clerget	Experimental	80		4.50		9	Radial
		United States	Guiberson	A-980	185	1925	2.74	.188	9	Radial
		United States	Guiberson	A-918	240	2020	2.25	.261	9	Radial
		France	Hispano-Suiza		1100				14	Radial
		United States	Hawk	(*)					6	Radial
		France	Lorraine	Experimental	250				9	Radial
		United States	Packard	DR-980	225	1950	2.26	.229	9	Radial
		France	Panhard	Clerget (L)	100	1800	4.62	.124	9	Radial
		France	Panhard	Clerget (L)	200		3.50	.160	9	Radial
		France	Renault	Experimental					9	Radial
		Czechoslovakia	Walter	Packard (L)	225	1950	2.26	.229	9	Radial
TWO-CYCLE	LIQUID-COOLED	United States	Attendu	Navy Test	85	1620	3.60		2	In Line
		France	Lilloise	Junkers (L)	480	1900	2.30	.483	6	Double Crank.
		United States	Deschamps	Inverted	1200	1600	2.00	.393	12	Vee
		United States	Garuffa		240	1200	6.00	.173	9	Radial
		Germany	Junkers		200	1000	3.50		4	Double Crank.
		Germany	Junkers						6	Double Crank.
		Germany	Junkers	Jumo 4	650	1620	2.79	.287	6	Double Crank.
		Germany	Junkers	Jumo 5	540	2100	2.02	.533	6	Double Crank.
		Great Britain	Napier	Culverin	720	1700		.414	6	Double Crank.
		Great Britain	Napier	Cutlas	550		2.25		6	Double Crank.
	AIR	Great Britain	Sidarblen		90	1800		.396	3	In Line

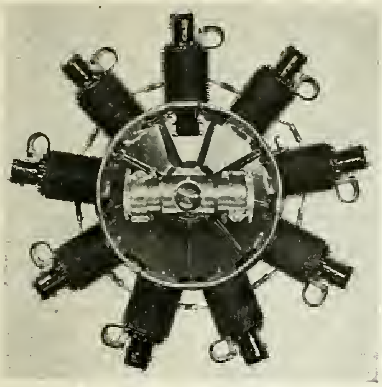
(*) Conversion (L) License

Principal known characteristics of aircraft engines of the Diesel variety

To elaborate further on the relatively small proportion of engineering effort expended on the Diesel type aircraft engine let us recognize the fact that some of these engines were built experimentally and, for unknown reasons, development was not continued to a point where they could be offered to the trade. Perhaps they developed troubles for which a satisfactory solution could not be found, or else the task of refinement required more time and expense than the project justified. These may be regarded as typical of many probable reasons why nothing further is heard of these experiments after their existence becomes known. As a rule, development work of this kind is conducted with considerable secrecy; it thus becomes exceedingly difficult to intelligently evaluate engineering progress with aircraft power plants in this category.

It is evident that, among four-cycle Diesel engines, the efforts are divided about equally between liquid and air-cooled types. The in-line types have received more attention than those in the liquid-cooled group, while all of the air-cooled designs are of radial cylinder arrangement. In contrast with the four-cycle variety, approximately one-half as many two-cycle Diesel aircraft engines have been constructed and, with one exception, all are liquid cooled. Due to the several Junkers models, together with the engines built by their licensees, the double-crankshaft opposed-piston designs command first position in the latter group. While the number of models constructed in each of these sub-classifications may be an excellent index to the distribution of engineering effort, it is by no means a measure of the state of refinement to which each group may be credited.

The Junkers design deserves a leading position for several reasons. This development started before the Armistice and, while it was discontinued for a time according to the terms of the Versailles Treaty, it has been an active project ever since. The design incorporates several unique features which produce certain advantages from a performance standpoint. No other two-cycle Diesel aircraft engine has performed as well, nor has one been subjected to so many hours of testing, either on the block or in the air; and it is doubtful if any Diesel design, or group belonging to any of the sub-classifications, can show a more complete performance record.



225 h.p. Packard radial Diesel

Possibly nothing of special importance can be illustrated by individually commenting upon the designs of the four-cycle group. However, it might be well to direct attention to the fact that the liquid-cooled models, whether new designs or conversions, were proposed primarily for use in relatively slow-speed bombing airplanes or lighter-than-air craft. The Beardmore *Tornado* has a background of considerable development, and the converted Rolls-Royce and Mercedes engines deserve special consideration because of the reputation of the sponsoring firms. About two years ago, the German Diesel-engine pioneering firm (M.A.N.) was reported to be working on the most powerful aircraft engine of this particular classification, but, so far, no descriptive details or performance figures have been made public. The Salmson is a very recent development, and not much is known of the other designs as far as performance is concerned.

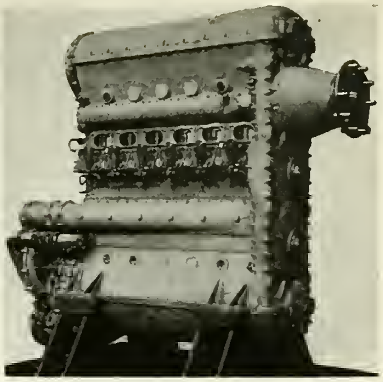
It is a question if the radial engine predominates the air-cooled four-cycle Diesel group because the cylinder arrangement is ideal for this manner of cooling, or because it lends itself well to the Diesel principle of operation. The Packard engine created a great deal of interest when it was introduced about five years ago, and within a short time two other American designs in the same class were introduced by Guiberson and the Aviation Diesel Engine Company. Although all of these engines have undergone considerable flight testing, they have yet to become adopted as standard power plants by any of the better-known aircraft manufacturers. Block tests of the Bristol *Phoenix,* and the Clerget designs built by Panhard, have been reported favorably, but we know very little concerning their performance in flight. The engine having the highest rated output—the Hispano-Suiza fourteen-cylinder design—was introduced only recently, and it will be some time before it will be able to demonstrate its usefulness.

The facts presented in this survey do not place the Diesel aircraft engine in a favorable light. Although 35 models are known to have been built, and probably as many more have been designed and experimented with privately, yet only a few have been developed to the point where they were regarded satisfactory for flying tests and, among the latter, none have been employed to any marked extent in regular service.

Statistics may be a reliable guide in many instances, but they do not convey a true measure of the worthiness of projects which lead into new fields of engineering. Surely the design of the 35 models to which we refer must have been encouraged through the belief that something better would result. Account must be taken also of the fact that even the development of this number of models constitutes a relatively small part of the effort and money expended on aircraft engines of other types. No doubt, a more equitable distribution in this regard would find, at least, the Diesel types in a more highly refined state, if not on an engineering par with other types. One may conclude that, in the aircraft field, the Diesel type has yet to win laurels, but it evidently possesses some distinct advantages if the work done so far really has any justification.

Let us now turn our attention to the more clearly defined advantages and disadvantages which the Diesel engine offers for aircraft use. From this the reader may be able to find ample reasons for the development which has gone before, and perhaps determine if further efforts along the same line promise to lead to a greater degree of reliability and performance, which is the primary aim of everyone having a hand in the design and development of aircraft power plants.

If one should ask "What are the prime essentials of an aircraft engine?", the obvious answer would be—low specific weight; low fuel consumption; a high degree of reliability under all sorts of operating conditions; reasonably long life; flexibility as related to response to the control of the operator; no excessive vibration throughout the operating speed range; as compact as the form permits without hindering accessibility both from the erection and maintainance standpoint; and finally, initial cost comparable to the gross work performed over the period of usefulness. This is conceded to be a large order, and yet we know that most modern aircraft power plants are endowed with a substantial measure of these characteristics. Naturally another type of engine, such as the Diesel, must possess all these essential features to a sufficient degree if it is expected to survive in the face of such strong competition. Where it fails to compare favorably in some respects, it must excell in others in order to maintain a balance of net worthiness.

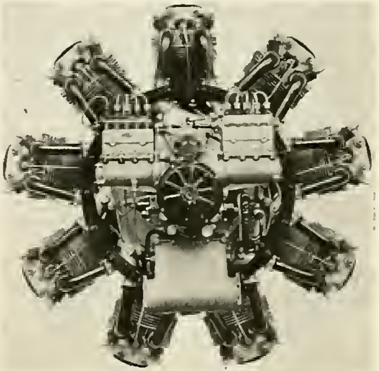


Junkers 6-cylinder Diesel

The table readily discloses that Diesel engines, up to this time, weigh considerably more than modern aircraft engines of corresponding output. One should not expect specific weights much under 150% of the lowest attained in the more common variety of aircraft power plant to which it may be compared. The additional ruggedness, which is deemed necessary in the structure of a Diesel engine because of the high ratio of maximum to mean cylinder pressures, means weight that no designer can eliminate with safety. The writer advances the opinion that much of the trouble experienced in compression-ignition engines for aircraft could be traced to the lack of rigidity resulting from designing for low weight.

The inability to secure lower specific weight in a Diesel engine is not a factor of such serious proportions when the gross weight of engine and fuel are taken into consideration. Undoubtedly, the foremost advantage of the compression-ignition engine is its high thermal efficiency at all loads. The statement that the specific fuel consumption of a Diesel engine is approximately 30% lower than that of the average four-cycle aircraft engine, which uses high grade gasoline as fuel, does not fully illustrate what such a saving means.

Let us assume, for example, that we have two 400-h.p. aircraft engines. One is a conventional engine (of any type)



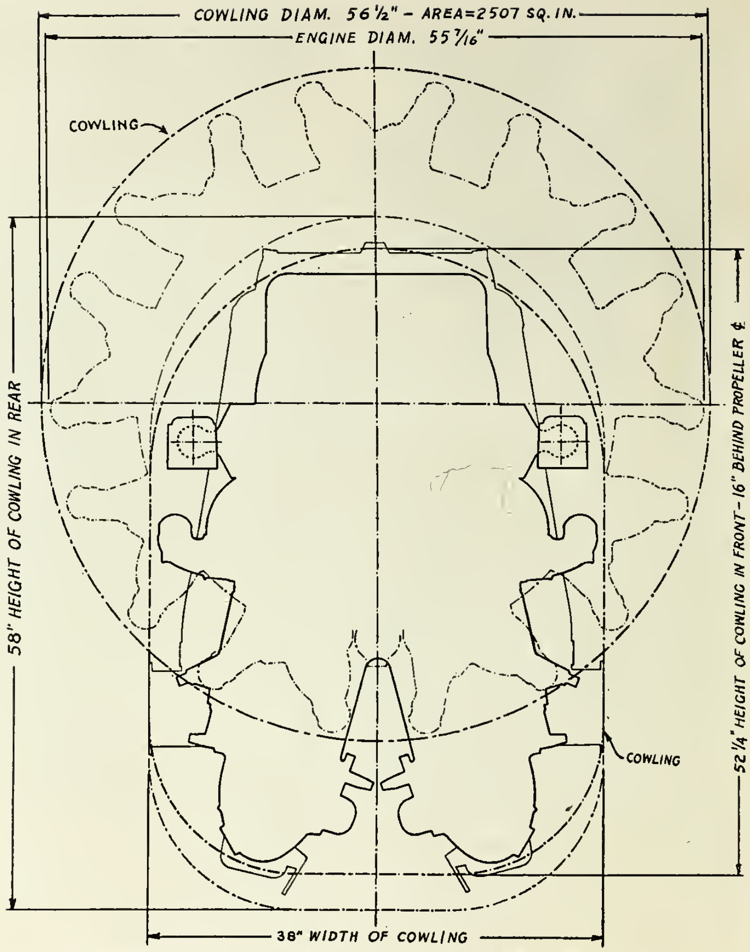
350 h.p. Bristol radial Diesel

which weighs 1.5 lb. per rated h.p. and consumes fuel at the rate of .500 lb. per h.p./hr. at full throttle. The other is a Diesel engine which weighs 2.25 lb. per h.p., but it consumes .36 lb. of fuel per h.p./hr. Simple calculation shows the gross weight of the two engines, together with the fuel consumed at full throttle, is practically the same for a flight of 5 hours 20 minutes. Consequently, the Diesel engine in this example shows to advantage in all full-throttle flights of a longer period, and we may cancel the weight objection, as far as performance is concerned, where the engine is used in long-range operations. This relationship changes slightly for part-throttle cruising, but not enough to alter the conclusions which may be drawn from this example.

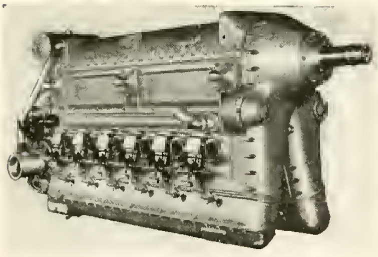
Apart from the improvement in performance which is possible with the Diesel engine in long-range aircraft, the saving in fuel costs should be a factor of considerable importance. The engine not only consumes less fuel, but a fuel which costs appreciably less.

A further advantage resulting from the fuel used by Diesel engines is the reduction of the fire hazard. Many consider this feature of such importance as to alone justify the development of the compression-ignition engine, with particular reference to its use in lighter-than-air craft. Loss of fuel of the more volatile type through a broken tank or pipe following a crash usually surrounds the machine with a highly explosive vapor. A spark, or flame starting from a hot exhaust pipe, may ignite this vapor and so quickly envelope the machine in intense flames that rescue of the occupants becomes impossible. It is unlikely if a similar crash of aircraft powered by a compression-ignition engine would terminate thus. The liability of fire is partly reduced by the absence of the electrical ignition system, but to a greater extent by the fact that the exhaust pipes are much cooler. However, should a fire start, it would spread so slowly with fuel of lower volatility that the passengers might have some opportunity to escape.

With most of our modern aircraft equipped with lights, radio and electric starters, the hazard of a fire starting from an electric spark is not removed entirely by the absence of electric ignition. Features that appear more important are the reduction of interference with radio communication, and the lowered costs and greater simplicity which result from the elimination of such units.


COWLING DIAM. 56½" - AREA=2507 SQ. IN.
ENGINE DIAM. 55 7/16"
COWLING
58" HEIGHT OF COWLING IN REAR
52 1/4" HEIGHT OF COWLING IN FRONT-16" BEHIND PROPELLER ℄
COWLING
38" WIDTH OF COWLING

Comparison between the cross section of the cowling of the 1200 h.p. Deschamps Diesel engine and a conventional 700 h.p. aircraft engine



1200 h.p. inverted Deschamps Diesel

Little can be said as regards the reliability of Diesel aircraft engines because of their limited use up to the present time. There is no reason to assume that they will not prove equally as dependable as the commonly used types; and if we should judge this particular characteristic on the basis of the results with heavy slow-speed Diesel engines used for other purposes, we might become altogether too optimistic. This feature will depend mostly upon the refinement of each individual design, just as it does with other types of power plant. Accordingly, the life of these engines will depend, in no small degree, upon the same factor. No comparisons should be drawn, either with regard to reliability or life, until such qualifications are more clearly defined.

It frequently has been said that Diesel engines are less flexible to the controls, particularly with reference to starting. While this has been true in a number of instances, it is not necessarily an inherent disadvantage with these engines. A slightly higher starting torque is required because of the higher compression, yet starting should be accomplished without delay once suitable means for turning over the engine are provided.

The sources of vibration (as related to the balance of the moving parts) are identical in character among engines of any given number and disposition of cylinders. The magnitude of these vibrations will depend upon the size and speed of the engine, as well as the nature and quality of the design. Diesel engines can be balanced equally as well as any other kind, yet there may be some flexing of the material, when not distributed properly, as a result of the high forces which occur during the power stroke. Designers must acquire a full appreciation of the severity of the forces mentioned if they expect to develop smooth running compression-ignition engines.

The structural differences between the

(*Continued on following page*)

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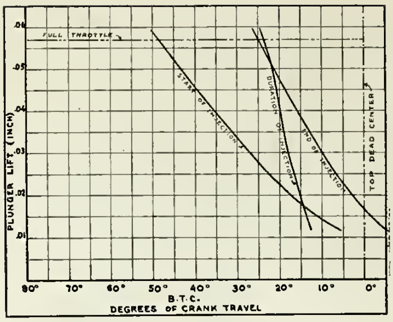
(*Continued from preceding page*)

two types of engines under consideration are not enough to mark one superior to the other from the standpoint of compactness. Engines of corresponding type and displacement will occupy approximately the same space. Instead of magnetos, carburetor and inlet manifolds on the one, there will be fuel pumps, fuel lines and injectors attached to the other. Likewise, there is practically no foundation for the opinion that all engines of one class should be more accessible than those of a rival group.

For the present, at least, the Diesel engine is the more costly to build. Possibly it may continue to cost more because of its greater weight. As a general rule, manufacturing cost can be computed by the pound for known standards of materials and workmanship. In place of expensive magnetos and carburetors, the Diesel engine has injectors, fuel pumps, etc., which still require such precision in manufacture as to preclude any possibility of a marked saving. However, the initial costs of engines do not represent a measure of their real value in every case. One must estimate on the basis of useful life, and add to the initial cost of the engine such expenditures as installation, maintainence, and consumption of fuel and oil for a given period of operation.

In this attempt to present the principal advantages and disadvantages of the Diesel engine for aircraft use, the remarks have been confined to general characteristics as applied to designs of various types. Wider distinction could be drawn in several instances by comparing designs having the same number and arrangement of cylinders, as well as the same rated output. However, such detailed examination is unwarranted for the present, since it is evident that the Diesel engine has little to offer outside the medium and high-power range.

The reader may conclude, from these remarks, that aircraft usage of Diesel engines will begin with the long-range weight-carrying craft, whether of lighter or heavier-than-air type, because their increased weight and cost do not prohibit their initial adaptation to craft of this type. Furthermore, in such service, the reduction in the amount of fuel required can offset the greater weight of such engines, and the decreased fuel costs will in time make up for any difference in the initial cost. Aside from concrete examples, which do not warrant examination at the moment, it has been shown that there are no outstanding differences between the two classes of power plant under consideration as far as the other essential characteristics for aircraft are concerned. Hence, the net gain in the use of Diesel engines for the aforementioned class of service seems to lie in reduced fire hazard, plus a substantial saving in the cost of operating over a long period of time. The proposition thus resolves itself into the question of whether or not the demand for aircraft engines possessing these features will be sufficient to justify the development expense. As for the Diesel type engine coming into general use for aircraft, there seems to be no foundation for the belief that this will be an early or sudden event. However, we may anticipate increased activity to accompany the development and refinement of this type for other purposes.



Graph of Guiberson injection timing

It would be a serious omission to conclude these remarks without commenting upon the possibilities of the two-cycle Diesel engine.

The inability to secure good scavenging and low fuel consumption has proved the greatest obstacle in the development of fuel-carburetted two-stroke engines. Now, the Diesel engine aspirates pure air, and there can be no such fuel losses during the scavenging process. These engines should have end-to-end scavenging and, consequently, be blower fed. While mean pressures may not equal those of four-stroke engines, (due to shorter valve opening periods and to heat limitations) they are in effect much higher since the power stroke occurs at each revolution. A two-cycle engine delivering a brake mean effective pressure of 80 lb. per sq. in. is comparable to a four-stroke engine developing 160 lb. per sq. in. b.m.e.p., and the latter figure is rarely approached, even with a high degree of supercharging, at the present time. It seems reasonable to expect that two-stroke Diesel engines having specific weight comparable to modern aircraft designs are within the realms of possibility. Thus, as the result of eliminating one of the most objectional features of the Diesel engine for aircraft uses, we may expect engine development to show an increasing tendency in this direction.

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Carburetor Ice Formation

Ice Formation in Carburettors, W. C. Clothier. Royal Aeronautical Society—Preprint for meeting February 8, 1935, 41 *pp,* 31 *figs.*

CONDITIONS UNDER which dangerous ice accretion in aircraft-engine carburetors may occur were investigated in order that the trouble might be avoided as far as possible, or in any case correctly diagnosed. The author discusses experiments into the freezing caused by the evaporation of the fuel and points out the effects of pressure, humidity and fuel volatility. He describes the test apparatus used in obtaining data as to the temperature distribution in a carburetor, the way in which ice builds up, and the degree of obstruction caused by such ice formation. He gives the results of tests on the rate of ice formation, effect of throttle opening, nature of the ice formation, and the effect of jacket and throttle heating.

Three solutions are recommended which, if correctly applied, would insure freedom from ice accretion in carburetor and induction systems. In regard to the use of alcohol added to the fuel, the author believes that, if added only as required to prevent ice formation by means of the de-icing device described, many difficulties would be avoided and more economical use of the alcohol obtained. He considers that jacket heating is another good solution, but would require a carburetor and induction system designed for this purpose. Intake heat with another cold-air intake for full-throttle use is the third solution.

Sport Planes

Aircraft and Engines of the Fourth International Challenge Race (Apparecchi e motori della IVª Challenge internazionale di turismo aereo), P. Ragazzi. L'Aerotecnica, Vol. 14, *No.* 11, *November,* 1934, *pp.* 1238-1267, 32 *figs.*

PROGRESS IN sport planes and engines since 1932, as shown by the designs participating in the Fourth International Challenge at Warsaw, is discussed. The author states that this race was not a hundred-percent representation of sport planes, but only represented aircraft prepared for the competition. He describes the Fiat A.70/S., Hirth H.M.8, Argus As.17, Menasco Buccaneer and Skoda engines as well as the Italian, German, Polish and Czechoslovakian planes participating.

(*Continued on following page*)

UP AND DOWN AND AROUND THE WORLD 29,000 MILES ON EDO FLOATS

As nonchalantly as changing from walking shoes to rubber boots, Dr. Richard U. Light equipped his Bellanca land plane with EDO Floats and took a leisurely trip around the globe. Accompanying him as radio operator was another skilled amateur, his friend Robert F. Wilson.

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Two views of Dr. Light's world plane—a standard Bellanca Skyrocket, powered with a Wasp 420-h.p. motor and equipped with Model 5400 EDO Floats. Full navigating and other equipment dictated by the need was carried.

Photo at top shows the plane taken from the water at Bombay, for the purpose of removing tropical sea moss from the floats. The photo below was taken on a wintry day at College Point, just after the return from the 29,000-mile trip.

★

EDO FLOATS

(*Continued from preceding page*)

Compressed-Air Tunnel

Results from the Compressed Air Tunnel E. F. Relf. Royal Aeronautical Society Journal, Vol. 39, No. 289, January, 1935, pp. 1-23 and (discussion) 23-30, 14 figs.

DEVELOPMENT OF the compressed-air tunnel is reviewed with details of the construction of the tunnel in operation at the National Physical Laboratory as well as of preliminary work associated with its special measuring apparatus. The results given for the tests conducted in the tunnel are mainly concerned with the aerodynamic behaviour of airfoils and of a model of the Parnall Parasol monoplane, the results being compared with full-scale data on the machine in flight. The author also deals with sphere drag tests, the drag of circular cylinders and the effect of Townend rings on the drag of a body with an air-cooled engine.

Seaplane Take-Off

Seaplane Take-Off Weights, E. T. Jones. Aircraft Engineering, Vols. 6 and 7, Nos. 70 and 71, December, 1934 and January, 1935, pp. 330-332 and 8-10, 6 figs.

FACTORS UPON which the maximum take-off performance of seaplanes depends are discussed in the first installment, while the second is devoted to a description of methods for increasing the present limiting take-off weights. The author concludes that, for this weight to be a maximum, the modern seaplane should be fitted with adjustable flaps, and that a certain percentage of these flaps should be designed for quick rotation to a large angle (40 degrees).

He believes that the hull bottom should have a shallow vee from well forward of the step to the first step, that the maximum beam at the chine should be small, and that the engines should be fitted with variable-pitch propellers, manually operated. He shows that the take-off performance of seaplanes can be greatly influenced by design without adverse effects on the air performance. He points out that there are two critical speeds and that failure to take-off occurs at the lower of these speeds in some seaplanes and at the higher in others.

Detonation of Fuels

Research on the Oxidation of Hydro-carbons and Their Agreement with the Detonation in Engines (Recherches sur l'oxydation des carbures d'hydrogène et ses rapports avec la détonation dans les moteurs), Suzanne Estradère and M. Aubert. Publications Scientifiques et Techniques du Ministère de l'Air, No. 49, 1934, 78 pp., 42 figs.

PREVIOUS RESEARCH on the oxidation of hydrocarbons is analyzed and compared with the results obtained by the authors in the research described. The authors discuss the preparation of such carbons as cyclohexane, cyclohexene, cyclohexadiene, benzine, hexane, hexene, heptane, heptene, heptine, methylcyclohexane and trimethyl. 2.2.4 pentane, and give the measurements obtained. They conclude that the temperature at which a phenomenon of determined oxidation is produced is a function of the carbon, the composition of the carbon-oxygen mixture, the time of contact, the pressure, and the dimensions and form of the apparatus.

Propeller Tests

Catalog of Propeller Tests (Catalogue d'essais d'hélices), G. Micheau. Etablissement d'Expériences Technique, d'Issy-les-Moulineaux, Section des Essais aérodynamiques, No. 2, July, 1934 (released January 13, 1935), 41 pp., 27 curves.

RESULTS of systematic tests on a series of Ratier two-bladed variable-pitch propellers are discussed. Six series of propellers were investigated in the full-scale wind tunnel, each series having as a base a propeller of different pitch. In discussing the influence of the distribution of pitch on the characteristics of the propeller, the author concludes that the passage of the distribution, constant to the increasing distribution, produces an effect in the same direction as an increase of pitch, while, inversely, the passage of the distribution, constant to the decreasing distribution, produces an effect in the same direction as a decrease in pitch, and that the constant, or nearly constant, distribution appears to correspond to the greatest efficiency.

Propellers

Cavitation of Marine Propellers and Ondation of Aircraft Propellers and of the Movable Lifting Surfaces of Flying Machines (Cavitation des hélices marines et ondation des hélices aériennes et des sustentateurs mobile des machines volantes), W. Margoulis. L'Aéronautique, Vol. 17, No. 188, January, 1935 (L'Aérotechnique supplement) pp. 1-8, 5 figs.

DEFINING AS ondation, the phenomena of loss of lift and increased drag when a propeller operates at tip-speed velocities near that of sound, the author describes tests of marine propellers in the hydrodynamic tunnel and shows how the choice of an aircraft propeller can be made in a similar fashion. He takes up the loss of efficiency by ondation in propellers of high-speed planes, as well as the ondation of lifting propellers for helicopters. He concludes with details of high-velocity wind tunnels which he has recommended for construction in France, including one for testing propeller models at a maximum wind velocity of 270 meters per second, another for testing wings, propeller profiles and projectiles at a maximum wind velocity of 450 meters per second, and a third to operate at a very high wind velocity of 1,000 meters per second.

Ferrous Metallurgy

Ferrous Metallurgy in Relation to Aircraft, W. H. Hatfield. Royal Aeronautical Society—Preprint for meeting, December 13, 1934, 54 pp., 22 figs.

STEELS IN use and available for aircraft and engine parts are discussed, including carbon, low-alloy, high-tensile alloy, case-hardening, nitriding, valve, high-thermal-expansion, and stainless steels, and carbide cutting tools. The author points out some of the special features in welding these steels, machining methods and causes for contact corrosion. He takes up internal stresses and corrosion stress cracking and the metallography of aero steels. Data given in the appendices consist of schedule of steels at present specified, application of steels to different parts, mechanical test data and physical properties of selected typical structural and rich alloy steels, heating and cooling curves of typical steels, and their microstructure.

Design Trends

The Paris Aero Exhibition, R. J. de Marolles. Aircraft Engineering, Vol. 7, No. 71, January, 1935, pp. 11-20, 44 figs.

TRENDS IN the design of British, French, Czechoslovakian, German, Italian, Polish and Russian airplanes and engines exhibited at the Paris Aircraft Show are analyzed. The author points out the tendency towards monoplanes, a new class of light twin-engined 6-passenger commercial planes, and retractable landing gear, and shows that the proportion of all-metal construction sinks below the 1930 level. He also describes design tendencies in the engines exhibited by 24 manufacturers, with special reference to the increasing popularity of the inverted engine.

Vertical Flight

Vertical Flight, J. A. Crowe. Aircraft Engineering, Vol. 6, Nos. 69 and 70, November and December, 1934, pp. 292-296 and 315-318, 13 figs.

CHARACTERISTICS OF the helicopter in comparison with those of the autogiro and cyclogiro are examined. The author takes up in detail the problems of the helicopter such as the provision of adequate lift, horizontal translation, safe vertical descent in case of engine failure, and the central problem of stability. He explains the reasons why the cyclogiro cannot, in its present form, rise vertically or hover and describes the influence of the autogiro on helicopter design. He does not believe that the autogiro or cyclogiro will ever compete with the airplane, having too many limitations, and concludes that it is not probable that the helicopter problem will be solved by the conventional helical screw machine or even the cyclogiro for reasons of stability.

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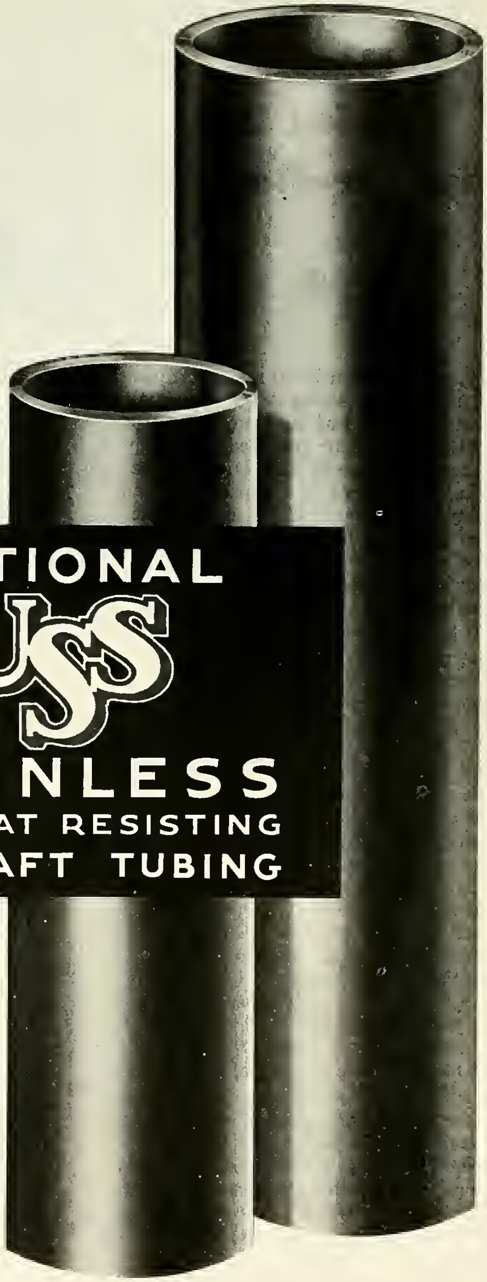

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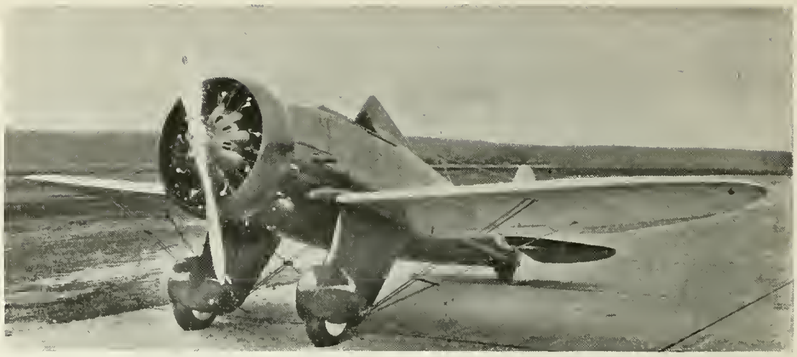
The Boeing Model 281 Fighter-Bomber



● Produced primarily for the export market, the Boeing Model 281 is an almost exact counterpart of the Army Air Corps P-26A pursuit plane described in the September, 1934 issue of AERO DIGEST. Featuring a top speed of 235 m.p.h. and an ability to climb to 10,000 ft. in 5 minutes from sea level, this plane is expected to have a wide foreign sales appeal by its manufacturer, the Boeing Aircraft Co., of Seattle, Wash.

It is an all-metal, low-wing, single-seat fighter powered with a 550 h.p. supercharged P. & W. Wasp engine, and can be operated in either of three conditions. As a fighter with normal fuel and equipped with two .30 caliber machine guns or one .30 and one .50 caliber gun, it has a maximum speed of 232.5 m.p.h. and a range of 386 miles at a cruising speed of 210 m.p.h. As a fighter with maximum fuel and the same military load it has a maximum speed of 230.5 m.p.h. and a range of 745 miles at a cruising speed of 208 m.p.h. In the former condition, the plane can climb to 17,900 ft. in 10 minutes and has a service ceiling of 28,200 ft. As a fighter-bomber it can carry either five 30-lb. bombs or two 122-lb. bombs at a maximum speed of 221 m.p.h. with a rate of climb of almost 2000 ft. per minute at sea level.

The Model 281's fuselage, with a length overall of 23 ft. 7.25 in., is of the semi-monocoque type construction with aluminum alloy bulkheads, longerons, skin stiffeners and smooth skin covering. The engine mount is a welded steel-tube structure, readily detachable from the fuselage.

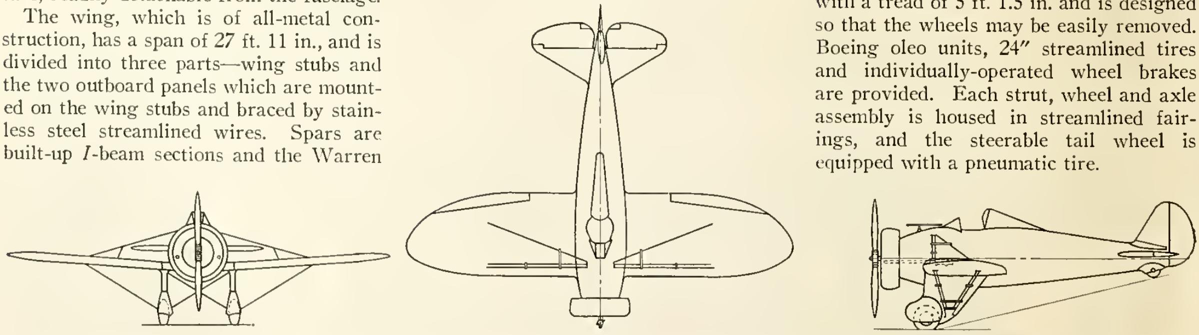
The wing, which is of all-metal construction, has a span of 27 ft. 11 in., and is divided into three parts—wing stubs and the two outboard panels which are mounted on the wing stubs and braced by stainless steel streamlined wires. Spars are built-up *I*-beam sections and the Warren truss-type rib structures are covered with aluminum alloy skin. Ailerons, measuring 6 ft. 11 in. are mounted on ball bearing hinges, providing easy and effective control.

Tail surfaces, of all-metal cantilever construction, have a span of 9 ft. 8 in. and are easily removable from the fuselage. Stabilizers are non-adjustable. Longitudinal balance is maintained by elevator flaps, controllable in flight from the cockpit. The fin is rigidly fixed on the fuselage in a slightly offset position to compensate for normal engine torque, and a small trailing edge rudder tab provides for additional correction of slight rigging variations. Rudder and elevators are mounted on ball-bearing hinges, providing smooth and light control. The rudder has no aerodynamic balance, but the elevators have an overhung leading edge which tends to reduce stick forces, insuring lightness of control under all conditions. In addition, the plane is provided with trailing edge wing flaps operated manually from the cockpit.

The landing gear is of the treadle type, with a tread of 5 ft. 1.5 in. and is designed so that the wheels may be easily removed. Boeing oleo units, 24″ streamlined tires and individually-operated wheel brakes are provided. Each strut, wheel and axle assembly is housed in streamlined fairings, and the steerable tail wheel is equipped with a pneumatic tire.

TABLE OF PERFORMANCES

	Fighter Normal Fuel	**Fighter** Maximum Fuel	**Bomber** Normal Fuel
Maximum speed at 11,000 feet (miles per hour)	232.5	230.5	219
Maximum speed at 6,000 feet (miles per hour)	235	233	221
Maximum speed at sea level (miles per hour)	215	213	203
Cruising speed at 11,000 feet (miles per hour)	210	208	197
Cruising speed at 6,000 feet (miles per hour)	210	208	197
Cruising speed at sea level (miles per hour)	196	194	183
Landing speed at sea level (miles per hour)	68.1	72	71.1
Rate of climb at 11,000 feet (feet per minute)	1840	1520	1540
Rate of climb at 6,000 feet (feet per minute)	2300	2010	2030
Rate of climb at sea level (feet per minute)	2210	1920	1940
Climb in 10 minutes from sea level (feet)	17,900	16,100	16,200
Time of climb to 10,000 feet (minutes)	4.6	5.3	5.2
Service ceiling (feet)	28,200	24,900	25,200
Absolute ceiling (feet)	29,200	25,900	26,200
Endurance at full throttle at 11,000 feet (hours)	1.10	2.14	1.10
Range at full throttle at 11,000 feet (miles)	255	492	241
Endurance at cruising speed at 11,000 feet (hours)	1.83	3.57	1.83
Range at cruising speed at 11,000 feet (miles)	386	745	360
Maximum range at 11,000 feet (miles)	575	1115	555
Gross weight (pounds)	3038.6	3380.2	3304



Three-view outline drawings of the P. & W. Wasp 550 horsepower Boeing Model 281 pursuit monoplane

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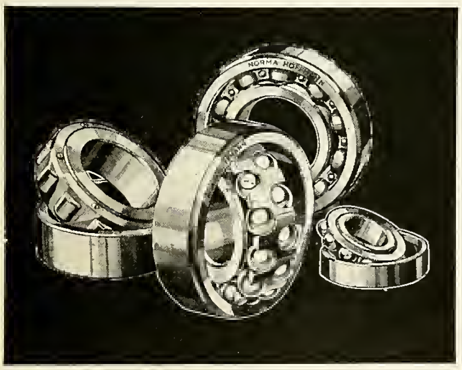

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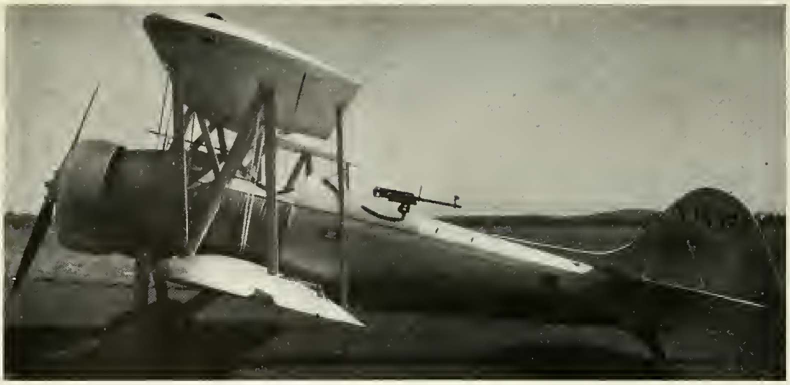
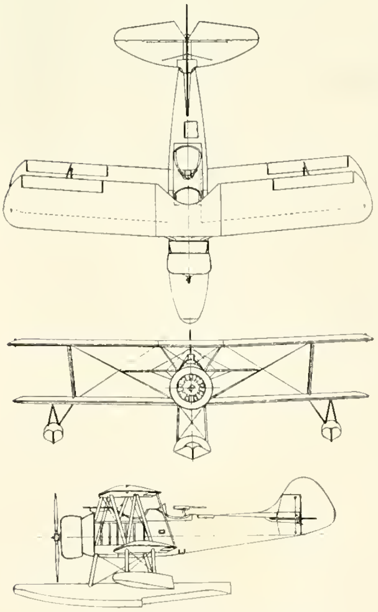


The Vought V-100 Corsair

● The V-100 Corsair Junior is a convertible two-place light military airplane similar to the standard V-90 Corsair in general appearance, type of construction, and flying qualities, but smaller in size and lighter in weight. It was particularly designed for light military operation by the Chance Vought Corp.

Useful load installations of the V-100 are patterned after similar installations in the standard two-seater Corsair, and this equipment may be readily installed or removed.

Structurally, the Corsair Junior is similar to, but simpler than, standard Corsair construction. A new type of removable fairing aft of the cockpits makes it possible to expose the entire fuselage for overhaul, after which the fairing is easily replaced. The landing gear is of the split axle, Vee oleo-spring type used on the more recently produced Corsairs, and is interchangeable with a single-float seaplane gear. A standard swivelling oleo tail is used.



Vought V-100 as a seaplane

The engine is a Pratt & Whitney Wasp Junior, Model SB developing 400 h.p. at 2200 r.p.m. at 5000 ft. A Hamilton Standard metal propeller and Eclipse hand inertia starter are standard equipment, and the engine compartment is fitted with a Phister pressure-type fire extinguisher. Fuel and oil systems are patterned after standard Corsair installations, with capacity for 88 gallons of fuel in two main tanks mounted in cushioned supports. Oil is contained in a welded aluminum tank of 6.5 gallons capacity.

Complete dual engine controls, instruments, and surface controls are provided, with brakes on the front pedals only. Seat and rudder pedals are adjustable and the rear seat and rear control stick are removable. Cockpit installations are similar to those of the standard Corsairs.

For instrument flying, the airplane may be equipped with a hood over the front cockpit. Under usual conditions, the instruments furnished are sufficient for such flight, but a directional gyro and artificial horizon may also be installed in the front cockpit. For aerial photography, the airplane may be equipped with an electrically-operated Fairchild K-3B camera mounted aft of the rear cockpit for operation by the observer. A short-wave transmitting and receiving set, especially designed for the V-100 by the Western Electric Co., may also be installed. It is of 10-watt carrier power, transmitting on any pre-selected frequency between 45 and 100-meter wave length, and has a normal operating range of from 50 to 125 miles.

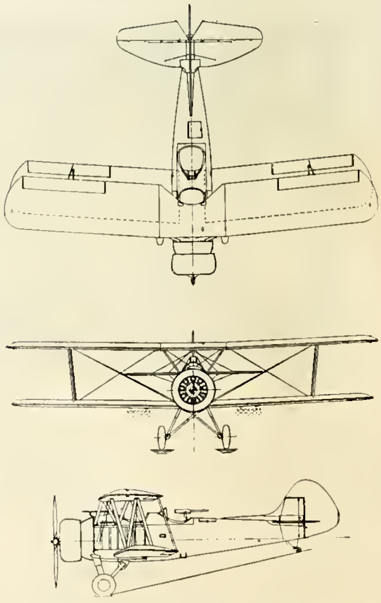
A new flexible gun mount (just developed by the Vought design staff) is of the combined post and track type, simple and rugged in design and permitting ready movement of the gun to any firing position. Its use in the V-100 Corsair Junior eliminates the Scarff ring, and makes possible cleaner and more compact rear cockpit design. With the rear control stick removed, and the rear seat replaced by a special gunner's seat which slides forward out of the way, the gunner has an unobstructed cockpit in which to stand and direct the fire of the Colt MG-40 flexible machine gun.

The plane is also equipped with a fixed machine gun (of the same type as the flexible gun) mounted in the fuselage, and synchronized to fire through the propeller. The gun is mechanically operated by a trigger on the front control stick, and an ammunition box for 500 rounds of ammunition and ejection chutes for the cartridges and links are provided aft of the fire wall. An open sight is installed on brackets above the fuselage forward of the pilot. The gun may be chambered for .30 cal., .303 cal., 6.50 mm., 7.00 mm., 7.65 mm. or 7.90 mm., ammunition.

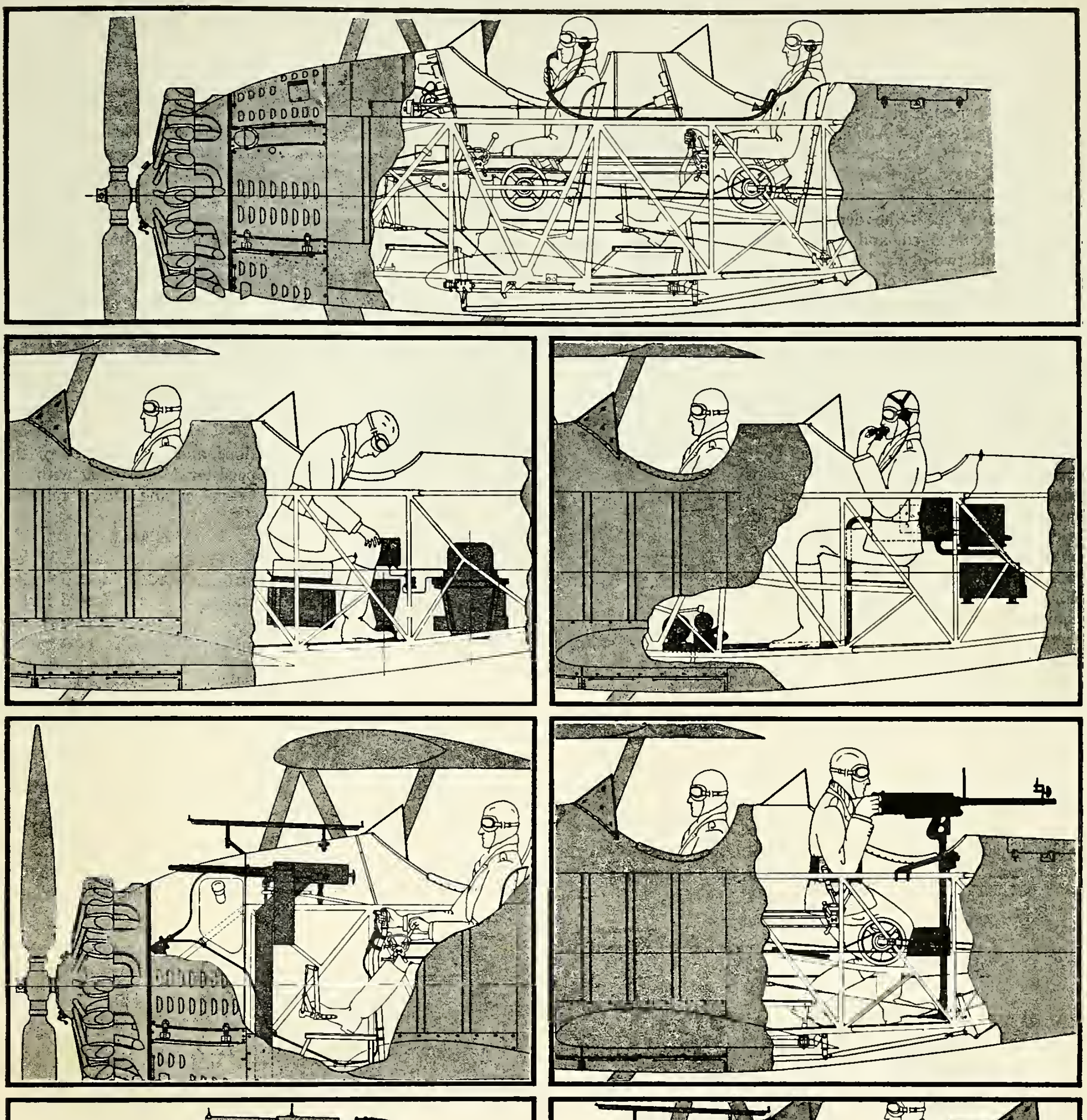
In addition, two A-3 bomb racks may be mounted under the lower wings. Release handles and an arming and safety handle are installed in the front cockpit.

Performance as a Landplane

Maximum speed at 5000 feet	155 m.p.h.
Landing speed	54.3 miles per hour
Rate of climb	1030 feet per minute
Service ceiling	20,500 feet
Cruising range	564 miles
Weight empty	2405 pounds
Useful load	1154 pounds
Gross weight	3559 pounds



Vought V-100 as a landplane



Cut away diagram of the convertible Vought V-100 Corsair Junior, showing various arrangements of the cockpit and equipment, including interphone, camera, radio, fixed and flexible machine guns, camera gun and bombs

Rearwin Two-Place Speedster Model 6000

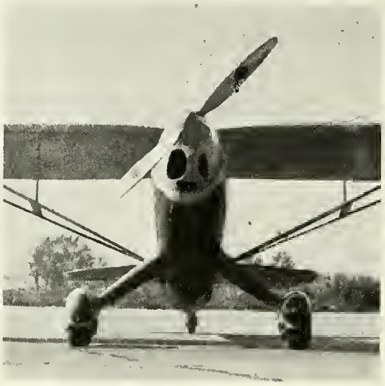
● A development program which extended over a period of two years came to a close when Rearwin Airplanes, Inc., of Fairfax Airport, Kansas City, Kans., brought its new Speedster Model 6000 from the shops for its initial tests.

Designed to meet the demands for a fast, easily controlled, and maneuverable airplane, this two-place, high-wing cabin monoplane presents a cleanly streamlined outline, refinements in structure, and comforts for the pilot and passenger.

The fuselage, which has an overall length of 21 ft. 6 in., is constructed of welded chrome molybdenum steel tubing, fabric covered, and is of rectangular shape faired to an oval section. In the enclosed cockpit are two seats in tandem, (with dual controls) above which is a transparent roofing which, together with the inverted position of the engine, and the wide windows, provides excellent visibility in all directions. In addition, there is a baggage compartment below and behind the rear seat and a completely equipped instrument panel is provided, featuring an air speed indicator, compass, tachometer, altimeter, oil pressure and oil temperature gauges.

Wings, of fabric-covered wood with an overall span of 32 feet, are rectangular with elliptical tips. The structure is of 2 laminated spruce spars, and girder-type spruce ribs, and duralumin leading and trailing edges. Ailerons are also of welded steel tubing, fabric-covered. The wings house two 17-gallon reinforced aluminum fuel tanks and are equipped with navigation lights. The landing gear, with a tread of 70 in., is of the fixed, divided-type with no wires or struts, and is equipped with 7.00 × 5 Autofan wheels and brakes and Rusco ring shock-absorbers. The tail wheel is of the steerable type with an 8 × 3.25 Goodyear streamlined tire.

Ball bearings have been utilized for all controls, and control wires are placed beneath the floor board together with the control mechanism.



Rearwin landing gear detail

The tail unit has a span of 108″, and is of the monoplane type. Steel tubing has been utilized in the framework, with the channel sections welded and fabric covered.

Enclosed in a stainless aluminum cowling is either an American Cirrus inverted engine of 95 horsepower equipped with a 78″ Hamilton Standard metal propeller, or the 125 horsepower Menasco C-4 air-cooled, inverted, in-line engine.

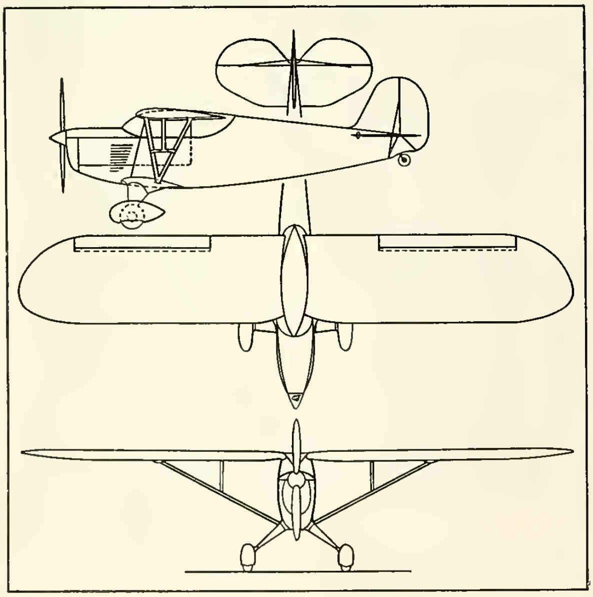
The Cirrus Hi-Drive engine is a four-cylinder, in-line, air cooled power plant with a compression ratio of 5.4:1. The bore is 4.33 in. and the stroke 5.125 in. Fuel consumption is .54 lbs./h.p./hr., and oil consumption, .02 lbs./h.p./hr.

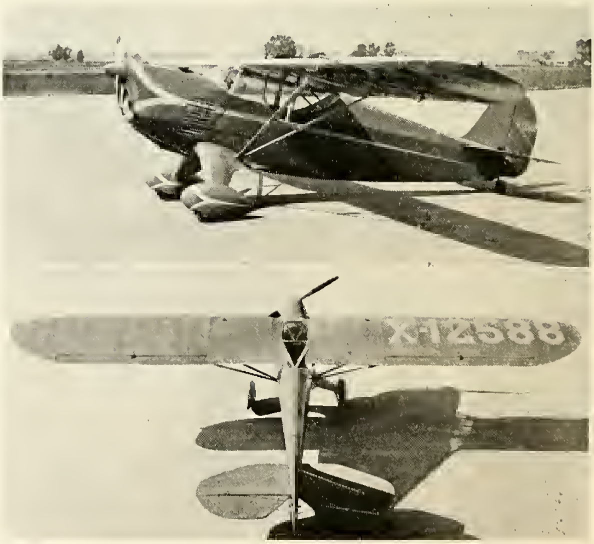
Each of the aluminum alloy cylinder heads are bolted to the cast-iron cylinder barrels by means of 4 long bolts extending to the crankcase. Fins are integrally cast on both the head and barrels. Valve seats are of phosphor bronze, screwed and shrunk in.

Specifications and performance of the Rearwin Speedster Model 6000 with the American Cirrus engine are as follows:

Specifications

Wing span	32 feet
Length overall	21 feet 6 inches
Height overall	6 feet 6 inches
Wing area	145 square feet
Power loading	16.9 lbs. per horsepower
Wing loading	11.05 lbs. per square foot
Empty weight	992 pounds
Useful load	613 pounds
Payload	220 pounds
Gross weight	1605 pounds
Fuel capacity	34 gallons
Oil capacity	2.5 gallons
Maximum speed	144 miles per hour
Cruising speed	120 miles per hour
Landing speed	39 miles per hour
Rate of climb	800 feet per minute
Cruising range	600 miles





Views of the 95 horsepower Rearwin Speedster

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★

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FOR the third time in three consecutive years, Berryloid Zinc Chromate Primer P-27 again dramatically proved its exceptional anti-corrosive properties. Under the most severe weather conditions on the tide water rack in Florida—lashed by sea water and baked under a broiling sun—this primer emerged as a definitely superior corrosion inhibiting finish. No wonder it is fully approved for use on Army and Navy aircraft! Write for latest descriptive folder today. Simply address—

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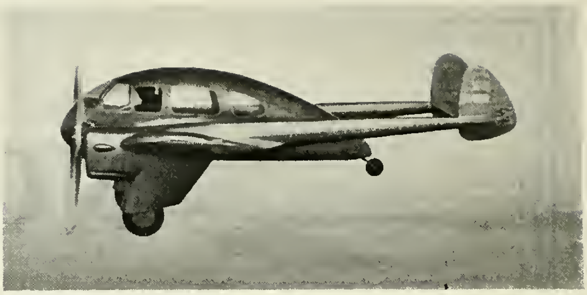
Twin-Engined All-Metal "Crusader" Streamline Cabin Plane



● Flight tests are being conducted on the Crusader, a low-wing, four-place, twin-engine, cabin monoplane designed by Thomas M. Shelton, and built by the American Gyro Co., of Denver. The ship which will be available for the private owner or the airline operator, both in the four- and six-place class, is of all-metal construction with the exception of wing tips and control surfaces, 17 ST duralumin being used throughout.

The 12-ft. center section embraces the engine nacelles, landing gear, fuel tanks, and cabin compartment. The wing, measuring 36 ft., is of the full cantilever, semi-stressed skin type, with 2 detachable outer wing panels, removable from points outboard of the engine nacelles. In the event of damage, new panels may be bolted in place, secured by 4 heat treated steel taper pins.

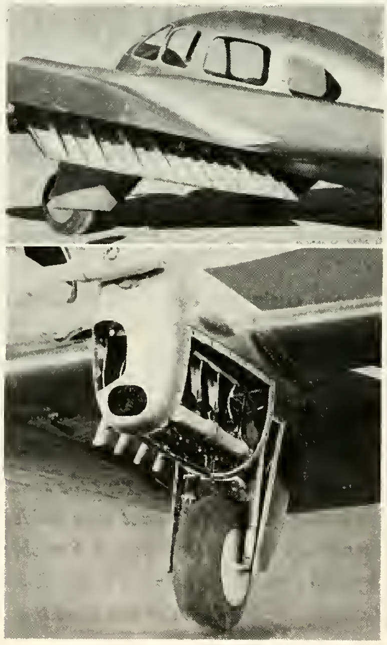
Two 25-gal. fuel tanks are on either side of the cabin, and valves are arranged so that fuel can be drained from the tanks separately or collectively for either engine. Either of the 125 h.p. Menasco engines can draw from either or both tanks.

A trailing edge flap, manually operated, extends from the body outwardly to the inner edge of the mass-balanced ailerons.

The cabin, which seats four passengers, has an average width of 4 ft. Entrance is by a door on the right side, the opening of which extends part way up around the top.

The cabin covering, as well as the other surfaces, are fabricated by using flush-type rivets. The instrument panel is illuminated for night flying and contains all engine and flight indication devices. Engine and flight instruments are grouped to give the board a symmetrical appearance. Plastocele 1/8" thick is used for the windows, the arrangement of which affords the pilot and passengers good visibility.

Tests are being made with a fixed and a retractable landing gear. For the retraction, the streamline wheels (each supported by 2 oil spring shock struts) fold up backwards and when retracted complete the streamlining behind the engine nacelles. Retraction is accomplished hydraulically. Hydraulic brakes are also used. The tail wheel, also of the streamline type, is mounted on a full swivelling fork with the swing dampened by a friction plate. Shock is taken by the low-pressure tire and shock chord.



"Crusader" flap and nacelle details

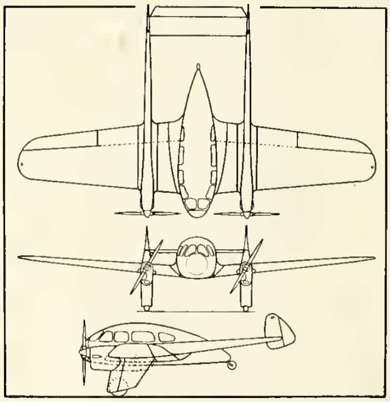
Despite the wide tread of ten feet and the short distance the tail wheel is back of the front wheels, the ship is stable on the ground, having no tendency to ground loop or porpoise.

Horizontal and vertical control surfaces are mass-balanced and supported at the end of 2 stiff, taper elliptical duralumin tubes of semi-stressed skin construction, which fair into the wing behind each engine nacelle, affording a well for the retracted wheels.

Preliminary flight tests were made with variable-pitch propellers which are being used temporarily. On its initial flight, the ship took off from the Denver municipal airport (5000 ft. altitude) in 8 seconds and landed at about 60 m.p.h. A model of this ship was wind-tunnel tested at New York University in June 1933, from which the following performance figures were calculated: high speed (at sea level) 233 m.p.h.; landing speed, 55 m.p.h.; maximum speed, with one engine, 150 m.p.h.

Specifications

Wing span	36 feet
Length overall	21 feet 8 inches
Height overall	7 feet 3 inches
Wing area	206 square feet
Tread	10 feet
Weight empty	2000 pounds
Useful load	1000 pounds
Gross weight	3000 pounds
Wing loading	14.5 pounds per sq. ft.
Power loading	9.6 pounds per h.p.



"Crusader" with wheels in landing position, outline drawing, and view showing position of retracted wheel

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NEW EQUIPMENT and METHODS

Arens Vernier Control

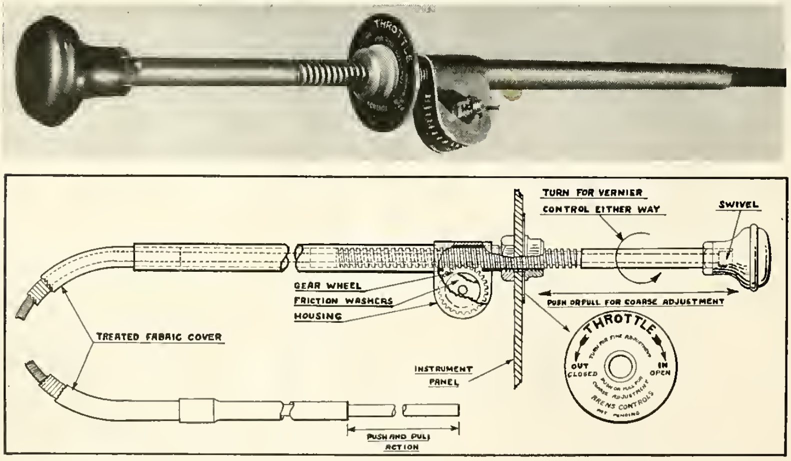
• SOME YEARS ago, Charles A. Arens invented and subsequently produced for use in the aircraft industry the Arens Control, a push and pull unit for controlling such remote points from the cockpit as engines, propellers, heaters, etc.

An improved Arens control now makes its appearance incorporating a Vernier feature. This new device, called the Arens Vernier Control, comprises a light, compact instrument-board unit with means for actuating a control at some remote point through a coarse or fine adjustment.

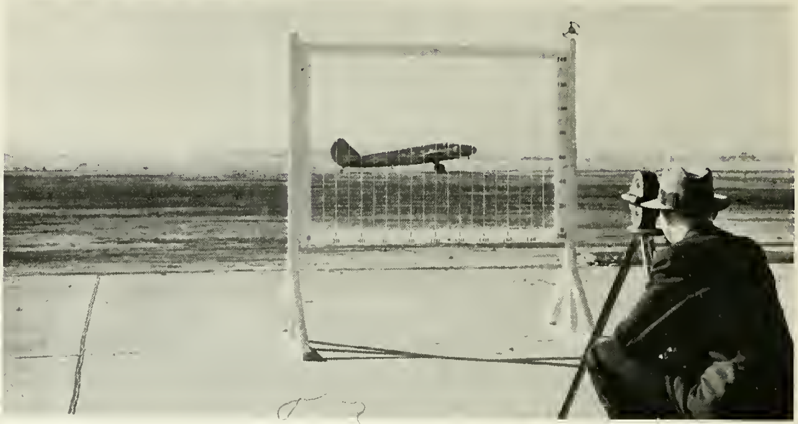
In many cases a quick acting coarse adjustment is desired, at other times a fine adjustment is necessary. Ordinarily these movements require two units with accompanying complications. In the Vernier Control, both movements are combined in one unit. The coarse adjustment is obtained by a straight in and out movement of a knob, and the fine adjustment by turning the same part. There are only two moving parts.

A plunger takes a movable gear which is in mesh and slides in a casing which has a bracket holding the gear. This gear has friction washers on either side, the friction being adjustable. The light frictional drag of the gear keeps the threaded plunger from creeping while this same friction also holds the gear which acts as a key when a fine adjustment is made by turning the knob. When the threaded plunger is moved in and out, the gear rotates, but when the plunger is turned the gear remains stationary and moves the plunger in and out. The plunger can be moved through its full working range by either a push-pull operation or by turning. The fine adjustment can be used at any place on the threaded portion and at any time without moving the plunger to an initial position.

Already, Mr. Arens, president of Arens Controls, Chicago, Ill., reports that orders have been received for this new unit from several aircraft companies. He also states that he is working on a lever unit which will incorporate this adjustment for multi-motored planes.



The new Arens Vernier Control for obtaining accurate adjustment by remote control



Determining the landing speed of aircraft by a new method developed by Boeing

Measuring Landing Speeds

• BOEING AIRCRAFT Co., Seattle, Wash., has just developed a simple and accurate method of measuring the landing speed of aircraft by photographs.

The equipment consists of a 35 mm. motion picture camera, a wire grid and a wind-speed measuring instrument — the anemometer. The grid, a large wood frame with vertical and horizontal wires evenly spaced, is set up ten ft. from the camera which is calibrated to determine the number of exposures per second. Cloth strips are placed 400 ft. from the camera, parallel to the grid, marking the line on which the plane must land.

As the airplane comes in for a landing, the camera is set in operation and wind speed is measured on the anemometer. The resultant motion pictures show the forward travel of the airplane and the angle of glide. By plotting the line of flight across the grid screen and by allowing for ground wind as measured on the anemometer, an accurate calculation of the landing speed can be obtained.

Boeing engineers have found that, after the films have been developed, the data can be obtained from it directly, or enlarged prints can be made and results determined from them.

Flight Recorder

• EVERY SO often there appears a unique and practical gadget which renders some useful aid to the pilot. The flight recorder issued by S. C. Johnson & Son, Inc., of Racine, Wisconsin, fits into this category, being helpful in the instantaneous computation of speed, time and distance when flying cross country.

Designed by E. H. Schlanser, head of the firm's aviation department, the calculator consists of two super-imposed rotating discs that contain three separate scales, easily identified. The time scale with limits from 10 min. to 6 hrs., is viewed through an aperture cut in the upper disc.

The speed scale, with limits from 35 to 300 m.p.h., and the distance scale, ranging from 10 to 700 miles, are mounted on the outer edges of the two discs. Accuracy within 1% is obtained, and the calculator will, in all likelihood, be supplied in combination with Johnson's Wax for aircraft.

Lear Radio Direction Finder

• ADAPTABLE FOR use on aircraft and boats, the Model K radio compass has been developed by Lear Developments, Inc., of New York, N. Y., for radio reception and for utilization as a homing device in unfavorable weather.

The unit is contained in a single metal cabinet and assembled on a single chassis which carries the radio receiver, the radio compass and the dynamotor. The cabinet measures 9″ × 7″ × 15″, and the entire model including a loop antenna, weighs about 40 lbs.

In addition to the compass-receiver there is a remote control unit and a special streamlined loop antenna assembly with interconnecting flexible cables. The cabinet can be located in any convenient spot and the remote control unit mounted at a point convenient to the pilot. The indicator meter can also be mounted in any spot within the line of vision of the pilot. Primary power is supplied either from a 6- or 12-volt storage battery.

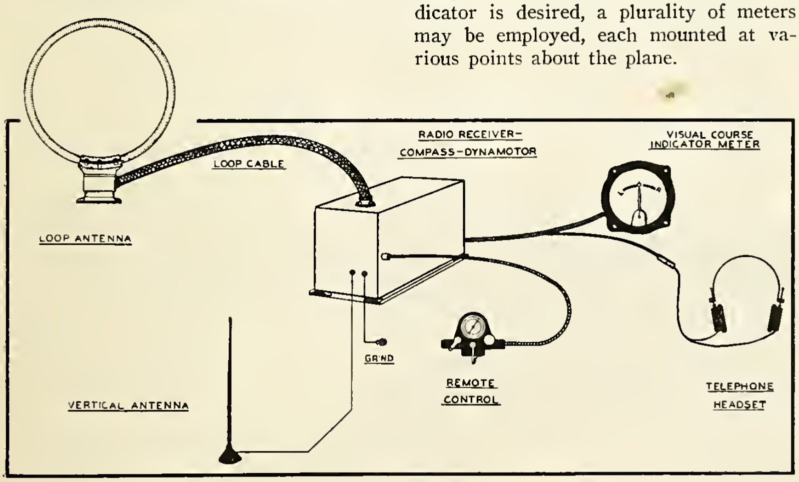
Externally, the radio compass requires only the installation of the 20″-streamlined loop antenna and the vertical aerial atop the plane. The loop antenna is completely enclosed in a weatherproof seamless aluminum housing and presents a low drag of 7 lbs. at 200 m.p.h. The vertical antenna is 30″ long, of ⅝″ diameter aluminum rod, and is utilized both for the radio receiver and radio compass. The instrument consists primarily of a three-band radio receiver which tunes from 195-415 kc, from 550-1500 kc, and from 2800-7000 kc in conjunction with which is a balanced modulator and audio oscillator.

The instrument can be used as both a regular radio receiver on any of the aforementioned frequencies or, by throwing a single switch, as a radio direction finder. Thus, the pilot has a combined radio receiver and homing device in one unit, both operated from a simple remote control head on the instrument panel. When used as a radio direction finder, the tuning range during the day extends to 300 miles; at night, the range increases to 1500 miles.

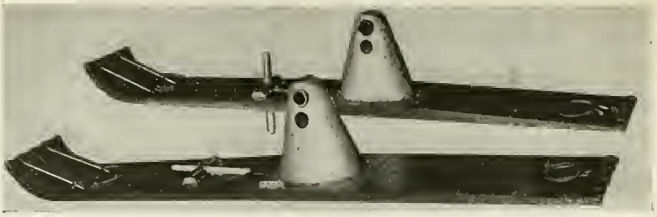
When used as a homing device, the plane is headed directly on course with the radio station which has been selected as an objective point. The needle then rests on zero center on the dial of the indicator meter. A movement to the right of the course causes the needle to swing right; a movement to the left of the course swings the needle to the left. No special step is required; the meter shows immediately that a radio wave has been tuned in and whether the plane is right or left of a direct line drawn between its position and the towers of that radio station. There can be no question whether the plane is going toward or away from the station tuned to, for when it is proceeding toward the station, right rudder will produce a right deflection of the meter needle while the reverse would occur if it were going away from the station.

A switch just below the meter turns the compass either on or off, converting the instrument from a radio receiver to a radio compass and receiver. A small electric cable connects to the meter from the compass receiver unit. Two or more meters may be connected to the one radio compass unit so that if more than one indicator is desired, a plurality of meters may be employed, each mounted at various points about the plane.

Diagrammatic sketch showing installation layout for the Lear radio compass



The Lear radio compass, Model K



Aircraft ski showing metal buckets for replacing the plane's landing wheels

Ski Equipment For Aircraft

• FEDERAL AIRCRAFT Works, Minneapolis, Minn., has developed a new ski employing a new principle of support, which enables a quick change of landing gear equipment in winter operations.

In the construction of the Federal Ski (which is approved by the Department of Commerce), simplicity is combined with strength by the use of a pivoted metal bucket, (or cone), mounted slightly to the rear of the bearing surface center of the ski. This gives the ski a natural tendency to climb when taxying through drifts of snow.

By using spruce wood, dural bottoms and runner stock, light weight is obtained. Even load-distribution results from using tapering wood runners which also insures flexibility in operating over rough ice or hard objects buried in the snow. Directional control and freedom from strain on the undergear is obtained by the minimum of side area presented by the ski, and by the location of the bucket, plus a tapering upward of the bottoms in all directions from the pedestal.

Federal skis are made in 14 standard types weighing from 36 to 390 pounds, and measuring from 10 × 44 to 32 × 135 inches. They are designed for planes weighing from 1,000 to 15,000 pounds.

The Four-Engined Savoia-Marchetti S-74 Transport

Side view showing clean design of fuselage and landing gear

● Societa Idrovolanti Alta Italia, manufacturer of Savoia-Marchetti type aircraft, has entered the commercial landplane field with a new four-engined, high-wing monoplane known as the Savoia-Marchetti S-74.

Particularly adapted for commercial transport service, the plane has demonstrated strength of construction, large load-carrying possibilities, spaciousness and luxury in the cabin, and safety in operations by its ability to maintain flight on any two of its four engines, and to remain afloat in the event of a forced landing on water.

The fuselage, of welded chrome molyddenum steel tubing is constructed in two sections to provide additional room in the interior of the plane. The passenger compartment, which measures 7′ 6″ × 6′ 6″ × 31′, is fitted to take two alternate seating arrangements; one for 20 armchairs with adjustable seats and backs and the other for 27 ordinary aircraft chairs. Soundproofing has been accomplished by inserting special anti-noise and insulating material between the outer plywood covering and the interior finish. Ventilation, both individually for each passenger and for the entire passenger-compartment, is furnished by automatic ventilators. For stratosphere flight, there is an installation which automatically provides oxygen to each passenger. Above the passenger compartment is a baggage compartment; another baggage space is situated aft of the pilots' cockpit while a third is underneath the passenger compartment. Large sliding, non-shatterable glass windows are on each side of the cabin, while aft is a bar and also a complete lavatory.

The pilots' cockpit is situated ahead of the engines and forward of the passenger compartment, separated from it by dural doors, the rear part of which is covered with varnished fabric. Dual controls are provided and non-shatterable glass windows enhance visibility from the pilots' compartment in all directions.

The wing is of the same section as utilized on the S-55 flying boats which flew from Italy to Chicago two years previously. It is constructed of wood, with three main spars in double *T* shape, former-ribs and internal stringers, all plywood covered. In addition there is also a fabric covering. The interior of all surfaces in the wing have been varnished with a special S.I.A.I. finish as has the outer fabric covering to protect the wood against atmospheric action.

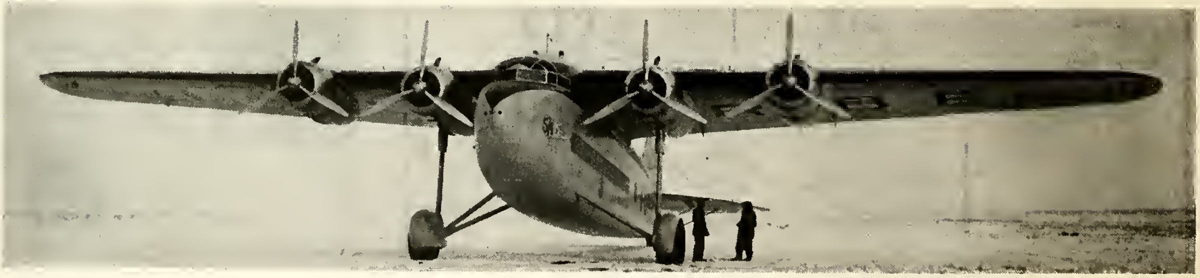
The tail unit is of conventional monoplane type, constructed of welded steel tube framework, fabric covered. All surfaces are balanced and the stabilizer is adjustable in flight, from the cockpit; the fin is adjustable on the ground.

A sturdy, split-type landing gear is employed. It consists of two telescopic legs, incorporating compressed rubber shock absorbers. The upper ends are attached to the inner engine nacelles and the lower ends are hinged to the lower fuselage longerons. Differentially controlled hydraulic brakes are attached to the rudder bar and each semi-balloon tire is enclosed in a streamlined fairing. The tail wheel is steerable and also is equipped with a shock absorber.

Engine nacelles are carried below the wing, the inner pair being reinforced to support the compression legs of the undercarriage. Four 700 h.p. Piaggio *Stella IX* engines, equipped with three-bladed controllable-pitch Savoia-Marchetti propellers, supply the power. Each is mounted on welded steel tube mounts furnished with elastic buffers to minimize vibration, and each has its individual fuel tank mounted and faired into the underside of the wing behind it.

Specifications and performance figures of the Savoia-Marchetti S-74 are as follows:

Wing span	98 feet 5 inches
Length overall	63 feet 11 inches
Height overall	18 feet
Wing area	1291.2 square feet
Weight empty	17,160 pounds
Gross weight	29,040 pounds
Useful load	11,880 pounds
Payload	6,600 pounds
Power loading	10.41 pounds per h.p.
Wing loading	22.55 pounds per sq. ft.
Maximum speed at 3280 ft. at 2330 r.p.m.	199 miles per hour
Cruising speed at 3280 ft. at 2050 r.p.m.	174 miles per hour
Service ceiling	19,680 feet
Maximum speed (3 engines)	162 m.p.h.
Service ceiling (3 engines)	9,840 feet
Maximum speed (2 engines)	124 m.p.h.
Service ceiling (2 engines)	3,280 feet



The Savoia-Marchetti S-74 transport for 20-27 passengers is powered by four 700 h.p. Piaggio engines

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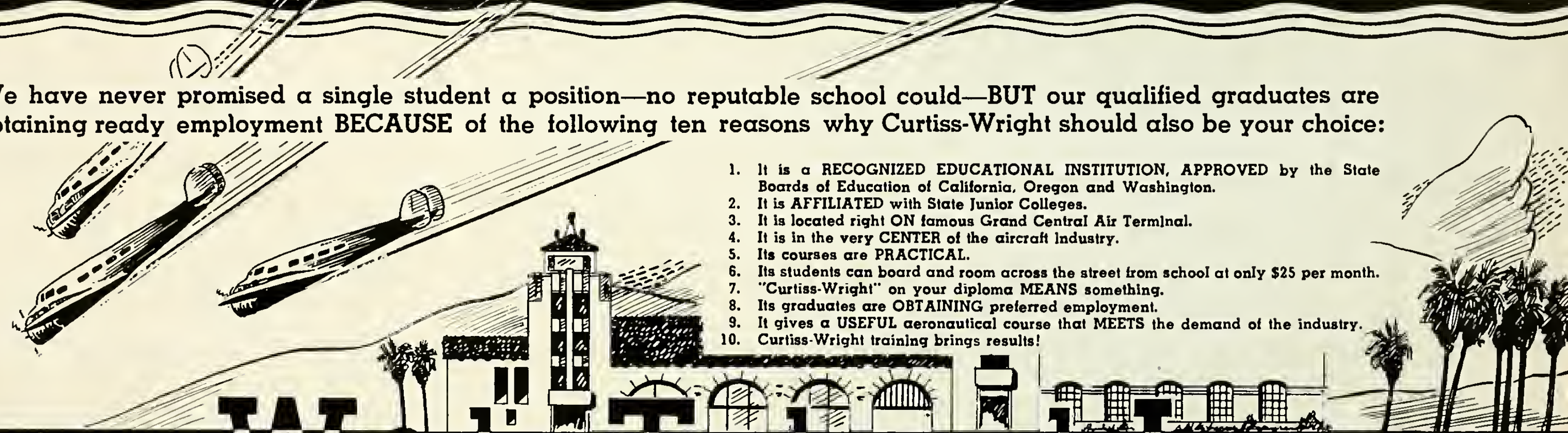

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AD 335

AIRLINES AND AIR TRAVEL

Pan American Forms Pacific Unit

JUAN T. TRIPPE, president of Pan American Airways, announced a new operating division to supervise the experimental service between California and the Orient. The head of the Pacific division is Colonel Clarence M. Young.

Others in the unit are C. H. Schildhauer, who will be operations manager for the Pacific; J. C. Leslie becomes acting engineer for the Pacific route; G. W. Adams, superintendent of communications; P. G. Klauck, acting accountant in charge of the division, and K. A. Kennedy, who will be acting traffic manager.

A California headquarters is to be established soon, probably for the time being in San Francisco. The company also applied to the Federal Communications Commission for a point-to-point radio broadcasting station to be established at Alameda, Calif., Hawaii, Marietta Islands, The Midway Island and Wake Island. Each would have a 1800-mile radius. It has leased Alameda Airport as a temporary terminal in the San Francisco Bay area, and has applied for lease for the establishment of a seaplane station on Wake Island.

New Schedules in Operation

ANOTHER COAST-TO-COAST schedule to Los Angeles over the midcontinent route via Salt Lake was inaugurated February 15, when Western Air Express added a second daily round-trip service with Boeing 247 transports over the Los Angeles-Salt Lake route, connecting at the latter point with United Air Lines' transcontinental planes. Acquisition of a fourth Boeing preceded inauguration of the new schedule.

Southbound planes of Bowen Air Lines now leave Dallas at 8 a.m. instead of 3 p.m., thus affording better connections with American Airlines' planes for points on the line to Brownsville.

Chicago and Southern Air Lines, Inc., is now operating an additional mail, passenger and express service between Chicago and St. Louis with tri-motored Stinsons.

Washington and New York are connected by a 1 hour 20 minute non-stop flight by Eastern Air Lines' Douglas transports, and if the service proves popular, five other round-trip schedules will be put on the same basis. The company also inaugurated new schedules to New Orleans from New York by an overnight flight in addition to daylight flights in each direction and also announced it was to resume stopping at Birmingham, Ala.

With the installation of lights on the St. Louis-Tulsa-Dallas-Fort Worth route and on the St. Louis-New Orleans route completed, night air mail service over these airways is expected to start soon. At the same time, the Post Office Department announced that Elkins, W. Va., will be added as a stop on AM-25, the Washington-Chicago route.

New day and night passenger schedules came closer to realization when Braniff Airways announced the purchase of seven Lockheed Electras. T. E. Braniff, president, expects to petition the Post Office Department to make the Chicago-Brownsville division one route, and plans to inaugurate the new service about July 1. The new schedules will be prepared to permit connections at Brownsville, Dallas, Kansas City and Chicago, so that Braniff planes will connect with those of other lines at those cities.

Transcontinental & Western Air began a daylight flight between New York and Los Angeles on a 17 hour 50 minute schedule. Planes depart from New York on a two-section arrangement, the first leaving at 8 a.m., and flying via Philadelphia, Pittsburgh, Columbus, Indianapolis, St. Louis, Kansas City and Albuquerque, arriving at Los Angeles at 11:50 the same evening. The second section leaves New York at 9 a.m. and is routed through Pittsburgh, Chicago, Kansas City and Albuquerque before arriving in Los Angeles at the same hour. The company now operates three daily transcontinental schedules in addition to three round-trips to Chicago in both directions. All schedules are flown by Douglas transports.

Airlines Achieve Milestones

UNITED AIR Lines and Transcontinental & Western Air, two of our major airline systems attained enviable marks during February.

United flew its 500,000th revenue passenger, making it the first company in the country to pass the half-million mark in passenger traffic.

Three million miles of transport flying with TWA's Douglas airliners was registered on February 4 when the "Sky Chiefs," the overnight coast-to-coast plane schedules over the Lindbergh Line, passed each other over the Cimarron river in northwestern Oklahoma. Since the first overnight coast-to-coast service in this country was inaugurated by TWA on August 1, 1934, both planes leave New York and Los Angeles at 4 p.m., and span the 2615 miles eastbound in 15 hours 55 minutes, with the westbound run made in 18 hours. There are 29 of these Douglas planes in operation by TWA.

Air Express Increasing

HEAVY GAINS in air express were registered in 1934 and the first two months of 1935 indicate there will be further advances this year.

The Railway Express Agency had a 102% gain in the number of air express shipments it handled last year and increases were recorded in all sections of the system which comprises 14 operators. The tonnage increase was 115%, and revenue showed a 90% gain for the year. United Air Lines, which is the largest operator in the system, reported that the heaviest portion of the shipments consisted of motion picture films, newsphotos, advertising material, clothing, reports and radio transcription records.

Bowen Air Lines became the eighth line to join General Air Express system, making available connections to important cities in Texas.

Personnel Changes

PILOTS, TRAFFIC men and other airline personnel were effected in various shifts by numerous airlines in preparation for additional services and the increasing business.

Don Waldbridge has become operations manager of Braniff Airways at Love Field, Dallas, succeeding R. C. Shrader, who became chief pilot. In addition, William Salathe, aviation editor of the San Antonio Evening *News*, was employed as publicity and advertising director and Nicholas Craig was named Chicago traffic manager.

Hugh S. Long has been appointed station manager for Pennsylvania Airlines at Pittsburgh; Richard S. Huested was named despatcher at Washington and Edward J. Geiger will be a despatcher at Pittsburgh. F. R. Clemens was made traffic agent in Milwaukee, and J. J. Scholze will be station manager there in his place. William W. Murray and J. T. Rinker have been named copilots on the eastern division of the Washington-Detroit route. C. W. Weiblen will be chief pilot on the western division and H. A. Dugan has been made maintenance foreman at Pittsburgh.

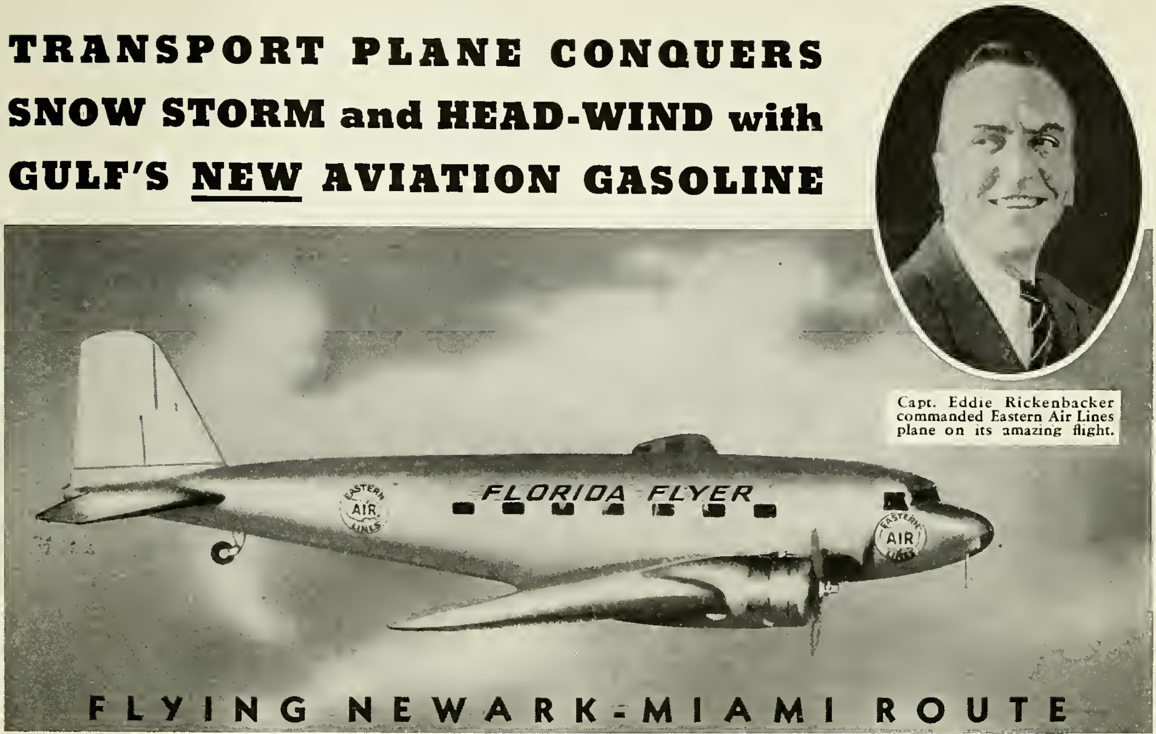
Appointment of the P. P. Willis Corporation of Chicago, as publicity counsel for American Airlines, Inc., was announced by C. R. Smith, president of the air transport company. William J. Dunn will direct the work in the agency.

Homer Merchant, traffic manager for the Portland district of United Air Lines, is taking over similar duties for the company in Los Angeles, and N. B. Rader who was assistant traffic manager in New York City has taken over the Portland post.

Walter Hosteller, who has served as manager of the airport at Gulf Port, Miss., joined Eastern Airlines as pilot.

(*Continued on following page*)

TRANSPORT PLANE CONQUERS SNOW STORM and HEAD-WIND with GULF'S NEW AVIATION GASOLINE

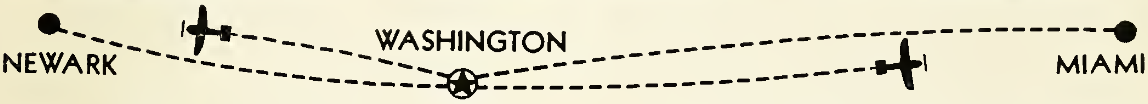


Capt. Eddie Rickenbacker commanded Eastern Air Lines plane on its amazing flight.

6:10 A. M.—away soars the Douglas Transport Plane from Newark Airport to find a bad snow storm and heavy winds.

On both north and south flights, Capt. Rickenbacker re-fueled at Washington-Hoover Airport with Gulf Aviation Gasoline.

3:46 P.M.—leaving the 36th St. Airport, Miami; the round trip is completed at 11:27 P. M. at Newark Airport.



CAPTAIN EDDIE RICKENBACKER, in charge of a Douglas Transport Plane from Newark to Miami, and return, and carrying 16 passengers, broke no records. He achieved even more. For he conquered a terrific snow storm, bucked a vicious head-wind, and overcame a miscalculation, further proving to a fascinated public the advantages of air travel.

And—he brought fresh laurels to Gulf's new Aviation Gasoline, on which he placed full dependence, by piloting his twin-motored Eastern Air Lines plane 2,400 miles in 17 hours and 17 minutes under adverse conditions.

No wonder that Eastern Air Lines and other leading transport companies insist upon *re-fueling exclusively* with Gulf Aviation Gasoline. Time and trial have proved consistently its quick starting, uniform quality, and smooth engine performance. It is made from the finest of crude oils and refined with the greatest care.

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Sign the coupon below for further proof of Gulf's progressive place in the aviation industry. A sample of an important new Gulf product will be gladly sent to you on request. Gulf Refining Company, Pittsburgh, Pa.

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(*Continued from preceding page*)

Airlines Make Changes

INAUGURAL AIRLINE service from the municipal airport at Portland, Maine, was instituted when Boston-Maine Airways, Inc., operators of the Boston-Bangor service, moved their base of operations from the airport at Scarboro to the new location which cuts by two-thirds the time to the business section. Development has resulted in construction of a 2000-foot N-S runway, while a second, from East to West, is underway. The new airport will become the terminal of a lighted airway from Boston.

Offices of Braniff Airways, Inc., in Oklahoma City will be shifted to larger quarters in the Braniff Building.

The name Western Air Express was revived recently as the highlight of many changes in this pioneer organization, more recently known as General Air Lines. New officers in the revived Western Air Express are Alvin P. Adams, president; Charles N. James, vice-president in charge of operations; W. J. Miller, secretary-treasurer; and Leo H. Dwerlkotte, comptroller.

Contracts Extended for 6 Months

THE SENATE passed and sent to the House a bill to extend for six months existing air mail contracts. Senator O'Mahoney said the bill made no change in the existing law, but would give Congress six months additional time to study the report of the Federal Aviation Commission.

The bill went through the Senate without further debate.

Wyoming Leases Boeing 247s

A FIFTH air transport line began operations with Boeing high-speed planes when new schedules were inaugurated between Denver and Cheyenne by Wyoming Air Service. Richard Leferink, president of Wyoming Air Service and W. A. Patterson, president of United Air Lines, announced that the latter company leased twin-engined Boeing transports to Wyoming Air Service and two round trip schedules are now being flown daily.

Forty minutes are required for the flight from Denver to Cheyenne, where passengers and cargo transfer to other Boeing transports of United Air Lines.

AT THE AIRPORTS

Airport Improvements

IMPROVEMENTS AT airports throughout the country are keeping pace with the increasing flying activity and the demand for better landing facilities.

At McConnell Field, Nashville, a temporary 18-plane hangar is being erected to serve until a new municipal airport is obtained. Two weeks of work by 100 laborers put the Jacksonville, Tex., municipal airport in better condition when the runways were gravelled and other improvements completed, and work has been started on the Kellogg, Idaho municipal airport under the direction of Clayton Shiplett.

Construction of a $69,000 combination administration building and hangar at Little Rock, Ark., has been authorized, and work is to get under way in the near future. At Chesapeake, Ohio, the airport will be improved by American Airlines which has completed plans for a new hard-surfaced runway 2500 × 100 ft., and an 80 × 100 ft., combination administration-hangar building, the total cost of the work amounting to $72,000. Meanwhile, the Greenwood, Miss., city council decided to install a lighting system at its field, supplying wiring installation and labor; the equipment will be furnished by the local Chamber of Commerce.

New Airports Planned

TWO NEW airports in Mississippi and one each in Texas, and Arkansas have been reported recently.

The Picayune, Miss., airport, constructed with CWA funds was dedicated as was the Magee airport. Both openings were featured by air shows attended by large gatherings. At the latter, 3000 persons saw stunt flying, races and passenger flights.

Longview, Texas, will probably get a new county airport following approval of a resolution by the local Chamber of Commerce which calls for a central field for Gregg County. An extensive program is planned. Prospects for a municipal airport at Nashville, Tenn., are encouraging and a committee has been selected to choose an appropriate site nearer the city than Sky Harbor, which is 22 miles away.

Saginaw Field Reopened

THREE YEARS of idleness at the Saginaw, Mich., airport came to a close recently when the city airport commission there decided to reopen the field, improve the landing area and reinstall flood, boundary and obstruction lights. Following the appointment of N. K. Warner as airport manager, the commission approved plans to purchase a 4-place plane.

The state-supervised FERA ground school there has 65 students and 30 members are expected to start training this spring.

Personnel Changes

THE APPOINTMENT of one new airport manager and the abolishment of a high airport post have been reported.

Capt. Charles R. Bowers has been made manager of the Bendix Municipal Airport, South Bend, Ind., replacing Homer Stockert and Rudolph Van Devere who have been co-managers. In announcing the appointment, the president of the local aviation commission said it was hoped that there would be a very close cooperation between the commission and the University of Notre Dame, with its projected technical course in aviation, the Bendix Aviation Corp. (operators of the airport), and the different aviation and pilot organizations in the city.

The position of assistant superintendent of Utica Municipal Airport at Marcy was discontinued.

Airports Busier in 1934

INCREASING ACTIVITY at airports is evidenced in 1934 traffic reports. Cleveland, Ohio, had 102,050 arriving or departing passengers, compared with 99,529 the year before. The number of transport planes increased to 27,418 from 20,417 the year before.

Union Air Terminal, Los Angeles, had a total of 41,680 landings, 38,976 passengers, 696,048 pounds of mail and 151,706 pounds of express during the year. The total number of persons who actually used the field was 128,876, an all-time high.

Early in 1934 Utica, N. Y., became a regular stop on the American Airlines' route. Since then, more than 1000 persons arrived at or departed from the field, with an increasing number of pounds of mail and express being recorded each month.

Memphis To Buy Airport

THE MEMPHIS, Tenn., municipal airport now operated by the city under a lease, is to be purchased by the city and additional improvements are to be made at a cost of $125,000 according to present plans. An approval of a $125,000 bond issue is to be sought from the legislature.

The present lease expires at the end of this year and as a safeguard to the city's investment, plans were made to purchase the land.

Portland Flying Service Sold

THE PORTLAND Flying Service, Inc., Scarboro, Me., airport has been purchased by F. Gilbert Pond and H. F. Troxel, who will transfer the property and operation to the new Portland City Airport at Stroudwater.

The flying service has a Government approved repair station certificate and will provide a 24-hour repair service. It will also operate an air taxi service and flying school and will carry a stock of aeronautical supplies. In addition it will offer aerial photography.

DON'T MISS THE APRIL

"Digest of American Aircraft, Engines, Accessories"

THE AMERICAN AVIATION INDUSTRY ON PARADE aptly describes the April AERO DIGEST. The only issue of its kind ever published—even exceeding in scope our April 1931 Directory Number—the "Digest of American Aircraft, Engines, Accessories" will be consulted frequently and for a long time to come as the only up-to-date "handbook" of American aviation.

Some idea of its usefulness may be realized from these brief outlines of its four individual sections:

1—Data on every commercial American airplane in current production—the executive personnel and export representatives of each manufacturer; descriptions of construction, dimensions, weights, performance, standard equipment, power plant, and other pertinent information concerning every type produced by each manufacturer; photograph and three-view blueprint.

2—Similar data on every basic type of American aircraft engine now in production—weights, dimensions, power, construction, materials, standard accessories; photograph; company personnel, etc.

3—List of all United States military aircraft grouped according to manufacturers; capacity, horsepower, purpose, etc.

4—A directory grouping of standard plane and engine accessories; manufacturers.

CAUTION—Manufacturers', sales and export representatives' advance orders for extra copies of the "Digest of American Aircraft, Engines, Accessories" necessitate our printing an additional quantity of the April issue. It is our belief, however, that these will have been allotted by the time that issue goes to press. CONSEQUENTLY, WE WILL NOT BE ABLE TO FILL ANY REQUESTS FOR BACK COPIES!

Furthermore, it has been our experience with similar issues that the newsstand supply is exhausted shortly after the issue is distributed.

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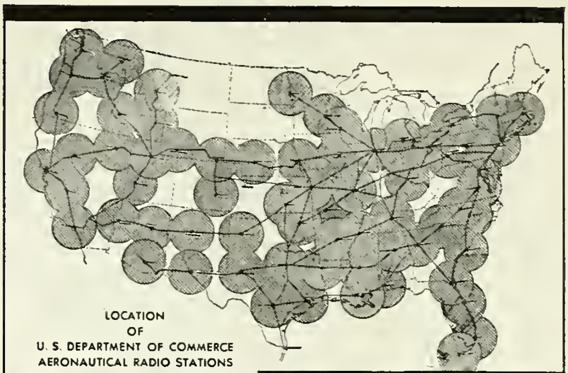

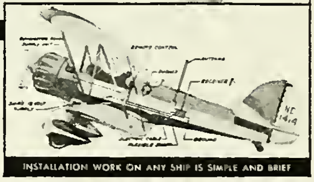

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"RADIO HEADQUARTERS"

ACTIVITY AT THE SCHOOLS

New Courses Available

INTEREST IN aviation has grown to such an extent that many universities have added courses to their curriculums, and flying and ground schools have instituted further training to meet the needs of the present industry.

Airport officials, weather bureau assistants and others interested in climatic conditions are taking a course in climatology in Columbia University Extension under the direction of V. P. de Smitt, hydrographer of the Western Union Telegraph Co.

A research center of aeronautical meterology, in cooperation with the Federal Weather Bureau, is being planned by New York University to conduct studies in the weather problems of aviation; undertake the training of meteorologists; and through its recently established weather bureau, cooperate with the government bureau in preparing frequent ground and upper air forecasts.

On April 1, Ryan School of Aeronautics, San Diego, Calif., will inaugurate a 12-month Master Mechanic course which will prepare students for immediate employment in aircraft factories and in maintenance departments. A feature of the course is a plan whereby students who have successfully completed the first nine months of their course will be actually employed in an aircraft factory during the last 3 months of their training.

Omaha Municipal University is offering in its extension division a course in air transportation designed for those who wish to enter aeronautics as a vocation; use the study as an aid to business; become associated with enterprises related to this industry; or include air transportation as a cultural subject in connection with public utility economics. Herbert W. Peterson will conduct the classes.

Parks Air College, E. St. Louis, Ill., will give each student in the executive transport pilot course 30 hours of training over a regularly scheduled air transport route. Using the St. Louis-Indianapolis airway, three flights will be made —two during the day and one at night— to familiarize the student with every phase of transport operations including plotting the course, choosing altitudes at which to fly, and becoming acquainted with the operation of the radio and with weather conditions.

Gray Joins Ryan Faculty

LT. COMDR. Lloyd R. Gray, U.S.N. (Ret.) has been appointed radio instructor at the Ryan School of Aeronautics, according to T. Claude Ryan. From 1930 to 1932, Comdr. Gray was district communications officer for the Eleventh Naval District, comprising all ship, shore and aerial activities in the San Diego area and from 1925 to 1927 held a similar post with the Fourteenth Naval District at Hawaii. Comdr. Gray will also be in charge of the training of Ryan students who enroll for residence courses in advanced Weems Navigation.

Students Form Glider Club

THE RISING Sun Glider Club was recently organized in Philadelphia, Pa., with S. Cohen as president; Thomas Jamison, vice-president; Nicholas Robak, treasurer; and N. Schmulenson, secretary. Membership, limited to twelve, is comprised solely of students enrolled in the Master Mechanics' courses at the Rising Sun Aircraft School.

The Club has purchased a glider and has established headquarters at the school.

Boeing Contest Popular

INTEREST IN the W. E. Boeing Scholarships seems to be greater than ever before, according to T. Lee, Jr.. General Manager of the Boeing School of Aeronautics, Oakland, Calif. Inquiries continue to be received at the school concerning the Sixth Annual W. E. Boeing Scholarships, which, as heretofore, will be awarded to college undergraduates on the basis of an essay contest. The closing date for this year's competition has been advanced to March 15.

1200 Take Michigan Courses

STARTED A little more than a month ago, the Aviation Ground Schools sponsored by the Michigan State Board of Aeronautics and conducted under the FERA Educational Program, have been approved at thirty-four cities with an enrollment in excess of 1200 students.

Courses include instruction in aerodynamics, theory of flight, aircraft engines, repairs, instruments and air commerce regulations. They are not intended as vocational training courses, but to give employed adults general knowledge of the basic principles of aeronautics so they subsequently can pursue a pilot's flight training course. New classes probably will be organized soon to include those who have intentions of learning to pilot and of owning their own airplane in the near future.

44 New Students Enrolled

AERONAUTICAL UNIVERSITY, Chicago, Ill., has been accredited by the State Board of Education, according to L. M. Churbuck, the school director, who also announced that forty-four new students have enrolled for classes, the greater part being for the Engineering courses offered by the institution.

Dallas School Gets Reapproval

THE DEPARTMENT of Commerce, at Washington, D. C., has renewed the approved school certificate of the Dallas Aviation School and Air College. Under this certificate, the school is authorized to operate as an approved transport, limited commercial, private and amateur pilot, ground and flying institution.

PRIVATE FLYING AND CLUB NEWS

New Clubs Formed

RECENT ADDITIONS to the fast-growing list of aviation clubs saw two organizations formed and started on their way toward activity in aviation.

Recently, the Aero Club of Parks Air College, joined the NAA and elected its officers, choosing N. G. Carper, Jr., president; F. M. Moore, vice-president; and W. M. Post, Jr., secretary-treasurer. Membership totals about 45, the majority being students at Parks Air College.

Pilots in the territory about South Bend and Mishawaka, numbering more than 50, recently perfected their organization in the administration building at the Bendix Municipal Airport. Membership was opened to licensed and student pilots in the towns adjacent, and The South Bend Pilots' Association was selected as a tentative name. Officers are: E. Lloyd Butz, president; Rudolph Van Devere, vice-president; Charles P. Schrader, treasurer; Harry S. Wagner, secretary; and Frederick Wharton, sergeant-at-arms; Van Devere, Homer Stockert, John Bittner, Lee Long and Carl Hartley are members of the board of governors.

A new Aero club open to both flying and non-flying members has been formed in Columbus, Ohio, to replace the old Aero Club, which has been inactive for several years. The following officers have been elected: Richard R. Bloss, president; Clayton Boone, vice-president; R. I. Morris, secretary; Ernest Camper, assistant secretary; Gomer Jones, treasurer, and Harry Lee, assistant treasurer.

Incorporation papers have been issued to the Ashland, Ky., Flying Club, an organization formed to promote aviation.

(*Continued on following page*)

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Announce

THE 1935 FLYABOUT

A time proven plane completely
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"America's First Light Cabin Plane"

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Those who use the Kruesi Radio Compass will not be disappointed in it. It is the only compass that has stood the test of actual service under the most severe operating conditions and has been adopted as standard equipment by the U. S. Army Air Corps and the U. S. Department of Commerce.

The Kruesi Radio Compass simplifies aerial navigation in clear weather—it makes flying in bad weather safer and more dependable than ever before—in fact, it makes flying possible under conditions which ordinarily would preclude safe operations!

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LIMITED COMMERCIAL PILOT'S COURSE	520.00
Executive Management with Limited Commercial Course	740.00
PRIVATE PILOT'S COURSE	375.00
Executive Management with Private Pilot's Course	595.00
MASTER MECHANIC'S FLIGHT COURSE	300.00
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(Continued from preceding page)

18,500-Mile Race Scheduled

TENTATIVE PLANS, wholly in the formative stage, indicate that if satisfactory arrangements can be completed, there will be an 18,500-mile race, international in character and modeled after the MacRobertson Race, this October or November along the coasts of North and South America. At this time, it is understood Elliott Roosevelt, Eugene L. Vidal and General Hugh Johnson are working on the project. Frank Hawks is ready to start a survey flight to pick control and intermediate landing sites.

The route favored is from Washington, D. C., down the east coast and across the Caribbean to Panama, then westward down the west coast of South America, crossing the Andes to Buenos Aires. The return flight would be by way of Rio de Janeiro, Para, Caracas and Mexico City to Los Angeles, and return to Washington by an as yet undetermined route.

Aero Clubs Renew Activity

THE SOARING Society of America has elected Lieut. Comdr. Ralph S. Barnaby, U.S.N., as its president, succeeding the late Warren E. Eaton. At the same time, Wolfgang Klemperer and Richard C. duPont were chosen vice-presidents; and Lewin B. Barringer, secretary-treasurer. The dates for the annual soaring contest were set for June 29 to July 14, inclusive. As usual, the meet will be held at Elmira, N. Y.

One year after its organization, the Lake City, Fla., Flying Club had logged more than 1000 hours, of which 750 were in the organization's Taylor *Cub*. During that period 20 students soloed, five more were near that stage, six received private licenses, one an L.C., and four will be ready for the private pilot test this summer. Dennis Powelson is president of the club.

The National Intercollegiate Flying Conference is scheduled to be held, under the auspices of the NAA, in Washington, D. C., on April 2-3. The Washington Aero Club is preparing a round of entertainment and plane demonstrations. William D. Strohmeier, of Amherst College, is chairman of the committee on organization.

The Sportsman Pilot's Association has also chosen Washington for its organization conference on March 8 and 9. Both days will be devoted entirely to business discussions, but on the evening of the second day, a banquet will be held in the Mayflower Hotel.

Disregarding the cold, 12 members of the Indianapolis, Ind., Aero Club staged a spot-landing contest at the municipal airport recently. It was won by William D. Mitchell who came 10 ft. 7 in. from the mark.

Whitman Heads Buffalo Club

NEW OFFICERS appointed by the directors of the Aero Club of Buffalo, N. Y., included Ray P. Whitman, vice-president of Consolidated Aircraft Corp., as president. Other officers are E. Howard H. Roth, vice-president; Ralph S. Damon, secretary; Dr. R. L. Scott, assistant secretary and R. S. Madison, treasurer.

Pilots Form Cooperative Group

LOCAL PILOTS in Fort Wayne and South Bend, Indiana, have organized pilots' associations composed of holders of department licenses and student permits operating from the ports in the two cities, and will attempt to work in close harmony with the aviation commissioners in the conduct of the ports and the observance of rules and regulations.

The associations have as an objective the defeat of any proposed state legislation looking toward the creation of a state aviation bureau. The Fort Wayne group fears that such a department would add greatly to the financial charges upon owners for licenses and taxes necessary to maintain state supervision. Federal regulations are considered adequate for the safe supervision and control of pilots, owners and students.

Oregon Appoints Air Committee

OREGON IS participating in the nation-wide movement to coordinate civic aeronautics with one permanent national group, and has appointed men to represent it. They are L. B. Hickam, chairman; Tex Rankin, in charge of the educational committee; Cyril Thompson, legislature, and Harry Coffey, publicity. They will function, with additional members, with the joint aviation co-ordinating committee in Washington, D. C., and will represent the Aeronautical Chamber of Commerce, N.A.A., the Independent Aviation Operators of the United States and the National Association of State Aviation Officials.

Air Club Celebrates Anniversary

THE OKLAHOMA City Aviation Club, now entering its second year of existence, is composed of 80 individuals who are either pilots or are interested in the development of aviation. Moss Patterson is president.

A new club room was recently opened in the Huckins Hotel, and regular meetings and functions of the club will be held there.

During the past year, the Club has cooperated in the development of new fields throughout the state and has also sponsored two air tours.

In the second year of its organization the club plans to hold week-end tours to prominent cities in neighboring states to promote good-will between Oklahoma City's aviators and those of the cities visited, and to advertise the facilities offered in Oklahoma City.

Club Provides Flight Training

THE ST. JOSEPH Valley Aviation Club, South Bend, Ind., has completed arrangements for the operation of a Taylor Cub plane, as a part of its activities. Instruction is to be given to club members, and those proficient in flying are to have use of the plane for practice work within 10 miles of the municipal airport in South Bend. The club plans to purchase the plane in the near future.

Club Students Near Rating

ALTHOUGH FORMED less than six months ago, the Dawn Patrol Flying Club, New Kensington, Pa., has increased its membership to 14, of whom eight are ready for their amateur ratings.

Instruction is given in an Aeronca by A. J. Leeward, president of the club, at the Vandergrift Airport, Vandergrift, Pa.

Survey Costs Reduced by Plane

AERIAL SURVEY is being used in the state of Washington for locating highways, rights of way for power, light and telephone companies, pipe line construction, geological study, flood control, tax assessment, city planning, location of faults for the drilling of oil wells, archeology and for measurement of wheat allotments in connection with the AAA.

Wallace Aerial Surveys, Spokane, is engaged in this work, flying a Stinson, equipped for high altitudes and a Fairchild camera.

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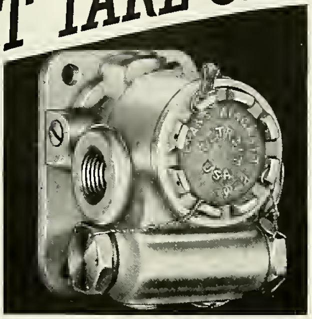

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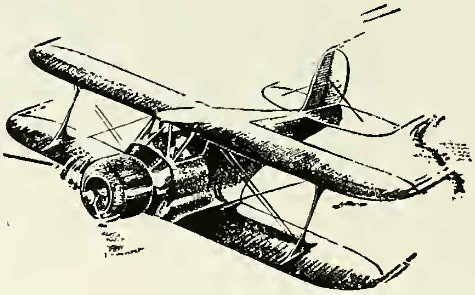

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THE AIR SERVICES

Plane Program Encouraging

THE GREATEST military program for this country in fifteen years was provided for in the War Department appropriation bill, which was reported from the House Appropriations Committee.

In addition to projected plans Representative John J. McSwain, chairman of the House Military Affairs Committee, urged a five-year aircraft construction program to provide 4,000 new planes for the Army and 2,200 for the Navy, and the maintenance of the policy of buying military aircraft on an open bidding basis.

The Army, under the bill, is authorized to contract for 547 additional planes at an estimated cost of $7,686,753. The committee said 450 planes for the regular Army and 19 for the organized reserves would be for replacement in 1935, at the end of which 1,367 will be on hand.

The Air Corps is allowed $45,600,444 as compared with $26,376,490 this year.

Fire Causes $100,000 Loss

FIRE OF an undetermined origin broke out in the Department of Commerce hangar at Bolling Field, Washington, D. C., destroying three planes, a fuel truck, four automobiles and a large quantity of equipment. According to unofficial sources the loss will amount to $100,000.

A new Stinson Reliant assigned to Eugene L. Vidal was among the planes lost in the blaze.

New Class Starts Training

ONE HUNDRED and thirty civilians and 20 enlisted men from the regular Army have been chosen to take the U. S. Army Air Corps training and begin their one-year instruction course at the Primary Flying School at Randolph Field, Dallas, Tex., on March 1. After eight months at Randolph, they will be transferred to Kelly Field for advanced flying, after which they will be assigned to duty for one year as flying cadets.

Bombers To Make Long Flight

TEN MARTIN B-12A bombers of the 31st Bombardment Squadron of San Rafael, Calif., were scheduled to depart from Washington, D. C. on March 1 for a one-stop flight to the Panama Canal Zone to obtain routine navigation and technical training. The one stop will be at Miami, Fla., for refueling.

The squadron will be commanded by Capt. Harold D. Smith who will be accompanied by 15 officers and 16 enlisted men. After leaving Washington, the squadron will fly the 918 miles to Miami and after being refueled will take off for France Field, Panama Canal Zone, the planes proceeding directly over the Caribbean Sea.

ELEVEN MILLION DOLLAR AIR BASE FOR HAWAII

PROPOSAL FOR the construction of an air base in Hawaii costing $11,000,000 and a recommendation for the purchase of 800 new aircraft were heard by the House Military Affairs Committee in a conference with the General Staff. In addition, plans for strengthening coast defenses were also discussed.

Pursuit To Become Attack

THE 17TH Pursuit Group, March Field, Riverside, Calif., is shortly to be changed to the 17th Attack Group, according to a recent announcement.

It is understood the squadron will be equipped with the new Northrop Attack plane, 110 of which were recently ordered by the War Department. These are low-wing all-metal jobs capable of a speed of at least 215 m.p.h. The plane has been seen at March Field on several occasions as a result of test flights from Inglewood and its performance and appearance have made a deep impression on its prospective future pilots.

Industrial College Class Chosen

ACCORDING TO the War Department, 43 officers of the Regular Army have been selected for detail as students at the Army Industrial College, Washington, D. C. for the 1935-36 course. These officers will report between August 15 and 21, 1935.

Eight Air Corps officers are included in the group. They are Lieut. Col. Henry B. Clagett, Kelly Field; Majors Hubert V. Hopkins, Fort Leavenworth; Clinton W. Howard, office of the Chief of the Air Corps; Captains Merrick G. Eastabrook, Jr., and Pardoe Martin from the office of the Chief of the Air Corps; Muir S. Fairchild and Arthur W. Vanaman, Maxwell Field; and Lieut. Park Holland from Wright Field.

New Runways Sought For Hensley

CAPT. B. S. Thompson, commandant of Hensley Field, army reserve officers' field in Dallas, is seeking government aid on a work relief project to construct two new runways at the field, the cost of which is estimated to be $110,000.

A program for the construction of four runways was undertaken last year under the CWA and was half completed when the CWA was discontinued. Completion of the work was delayed because of the large amount of material required.

Navy Planes On Mass Flight

TWENTY-FOUR navy planes in three squadrons, flying the Caribbean from the Canal Zone, arrived at San Juan, Puerto Rico with Rear Admiral A. W. Johnson, commander of the aircraft base force, in charge.

The squadrons started from Martinique, Guadalupe and St. Vincent in the morning and met over the Virgin Islands, arriving in San Juan in formation after maneuvers at Culebra. After flying 4,000 miles, the squadron completed its cruise at Colon, Panama.

500 Planes In Summer Maneuvers

MORE THAN 500 Navy planes will join with surface vessels in mimic war in the Hawaii-Alaska-Puget Sound triangle this summer when the fleet performs in regular maneuvers.

Among the craft will be 45 new seaplanes with a cruising range of 3000 miles and it is expected their performance will be closely watched to enable a determination by the Bureau of Aeronautics of designs for the $12,500,000 building program planned for next year.

All four aircraft carriers, with planes from Pearl Harbor, Hawaii, and those stationed regularly on battleships and cruisers, are to participate.

Reserves Elect Officers

THE FIFTH Corps Area Air Reserve Association recently elected the following officers for the ensuing year: Major A. L. Pritchard, president; Lieut. J. E. Matthews, vice-president; and Major Sidney Park, secretary-treasurer.

The new executive committee includes Major William Center, Capt. William Cahill, Lieut. A. N. Goldsmith, Major Charles Cox, Lieut. John Biggerstall, and Major A. J. Tabor.

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THE INDUSTRY IN GENERAL

Commercial Production Increases

THE FIRST eleven months of 1934 witnessed production of commercial aircraft and engines that far exceeded similar activity in the same period of the preceding two years.

Commercial aircraft production was 44.2 per cent higher than for the same period in 1933, and 294.4 per cent more than 1932. The average unit value increased from $4,263 in 1932, and $10,784 in 1933 to $12,129 in 1934, showing an increasing proportion in larger planes. During the 11 months of 1934, according to the Aeronautical Chamber of Commerce, 721 commercial airplanes, worth $8,744,824, and 1,950 engines, valued at $9,722,795 were produced. Commercial deliveries during the period under consideration were 727 for aircraft, valued at $8,078,654 and 1,852 engines, worth $9,222,375.

Military aircraft production was slightly below 1933 levels. While 417 airplanes and 602 engines were produced, and all except three aircraft delivered, their combined value is 6.3 per cent and 4.5 per cent, respectively, less than the previous year.

Taken by individual months, the Aeronautical Chamber reports that September, October and November 1934 showed from two to six times as great activity as the same months of 1933.

The value of all aircraft and aircraft engines produced, commercial and military, is, respectively $17,000,330 and $14,075,205.

Morgan Reelected Aero Chamber Head

THOMAS A. MORGAN was reelected president and Leighton W. Rogers executive vice-president in charge of activities, at the recent election of officers of the Aeronautical Chamber of Commerce, at which all incumbents were reelected with the exception of the Board of Governors.

Vice-presidents re-elected include Donald W. Douglas, president, Douglas Aircraft Co., Inc.; Reuben H. Fleet, president, Consolidated Aircraft Corp.; Alfred Frank, president, National Parks Airways, Inc., and Elliott Roosevelt. Other officers are G. M. Bellanca, president, Bellanca Aircraft Corp., secretary; Charles L. Lawrance, president, Lawrance Engineering & Research Corp., treasurer; Fowler Barker, assistant secretary and Frank J. Walsh, assistant treasurer.

The new Board of Governors includes Messrs. Douglas, Fleet, Morgan, Lawrance and C. Egtvedt, D. L. Brown, B. D. DeWeese, C. J. Brukner, G. W. Vaughan, S. M. Fairchild, Charles Marcus, George Wheat, J. H. Kindelberger, C. R. Smith, E. V. Rickenbacker, Croil Hunter, J. T. Trippe, C. B. Munro, Jack Frye, W. A. Patterson, O. L. Parks, G. W. Orr, Al Williams, Frank Tichenor, Reed Chambers and F. L. Smith.

Rearwin Distributor Appointed

F. W. BOWER has been appointed Indiana distributor for Rearwin aircraft manufactured by the Rearwin Aircraft Co., of Fairfax Airport, Kansas City.

Bendix Acquires Carburetor Firm

THE AUTOMOTIVE and aircraft subsidiaries of the Bendix Aviation Corp., have been augmented by the acquisition of the Zenith-Detroit Corp., which will hereafter be known as the Zenith Carburetor Company.

Operation of the Zenith company will be continued as heretofore in the Detroit plant according to Vincent Bendix. Through the addition of Zenith and in conjunction with its co-subsidiary, the Stromberg Carburetor Co., Bendix now makes available facilities for unlimited development in carburetion of all types, automotive, aviation and marine.

The executive staff of the Zenith company will continue to be headed by Victor Heftler who will be assisted by B. W. Westcott, vice-president and assistant general manager. The two companies, Zenith and Bendix Stromberg, will continue to function as they have in the past, that is separately, but will be in thorough cooperation.

Fairchild 24 cabin plane equipped with standard Edo floats

New Approvals Issued

DEPARTMENT OF Commerce approvals covering aircraft and engines have been issued to a number of manufacturers as follows:

The Lockheed Aircraft Corp., Burbank, Calif., received approved type certificate 559 covering the Electra 10-C, a 12-place closed land monoplane powered by 2 P. & W. Wasp SC1 engines rated 450 h.p. each. Another aircraft approval was issued to Beech Aircraft Corp., Wichita, Kans., covering model B17L Beechcraft, a 4-place closed land biplane powered by a Jacobs L4 engine of 225 h.p. The ATC number is 560. Meanwhile, flight tests are being continued on a new Cyclone-powered Beechcraft which probably will be one of the fastest commercial ships in regular production when it is ready for delivery.

The Fairchild 24 was approved by the Department as a seaplane following tests with standard model Edo floats at the Edo Aircraft factory in College Point, Long Island, N. Y. A further approval was granted the Wiley Post Aircraft Corp., of Oklahoma City, Okla., on the Wiley Post biplane manufactured there.

Engine approvals were granted to the Wright Aeronautical Corp., on the Wright Cyclone SR 1820-32, a 9 cylinder, radial, air-cooled engine rated 675 h.p. at 1950 r.p.m. at 6500 ft., and on the Conqueror GV-1570F-1, a 12-cylinder, 60° Vee liquid-cooled engine rated 675 h.p. at 2450 r.p.m. at sea level.

Pratt & Whitney received approvals on the Hornet S1E-G, a 9-cylinder, radial, air-cooled engine rated 750 h.p. at 2250 r.p.m. at 7,000 ft., and on the Twin Wasp S1A2-G, a 14-cylinder, radial, air-cooled engine rated 800 h.p. at 2400 r.p.m.

The Menasco Buccaneer B6S was approved as a 6-cylinder, in-line, inverted air-cooled engine rated at 200 h.p. at 2250 r.p.m. at 4500 ft.

Porterfield Takes Larger Quarters

APPROXIMATELY 100,000 square feet of floor space are now available to the Porterfield Aircraft Corp., which just moved into the Overland building in Kansas City. Facilities to produce five planes a week will be installed, according to E. E. Porterfield, president, who said the move increased the company's floor space about 2000 per cent.

Porterfield manufactures the two-place Flyabout, a high-wing cabin monoplane.

Company Name Changed

EFFECTIVE IMMEDIATELY, the name of the Kreider-Reisner Aircraft Co., has been changed to Fairchild Aircraft Corp., to more easily identify it with the Fairchild Aviation Corp., of which it is a subsidiary.

● *Man! Look at that plane go places!! What make is it?*

● *Looks like the Fairchild "45"—that new five place full cantilever low-wing, with a retractable gear. It'll be the talk of the country soon.*

Bureau Buys Tailless Airplane

THE BUREAU of Air Commerce has contracted with Waldo D. Waterman, Los Angeles, Calif., to construct one tailless airplane in accordance with plans and specifications which he submitted several months ago, to obtain one of a number of different designs to carry on experimental and service tests to determine the suitability of the design for a private-owned aircraft.

"Tailless airplanes have received considerable attention in England, France and Germany," John H. Geisse, Chief of the Bureau's Development Section, said, "but little has been done along that line in the United States. The tailless airplane may or may not represent the general outline of the airplane which will be in widespread use a few years hence, but it does show sufficient promise to merit a fair trial.

". . . It does start with one advantage, and that is simplicity of construction which would make it more readily adaptable to quantity production than some other types. If it proves to be equal in efficiency to other airplanes that we test, this adaptability to volume production methods will be an important factor in its favor."

The Bureau of Air Commerce previously contracted for 15 airplanes of a less radical type than that proposed by Mr. Waterman. These craft are being built by the Hammond Aircraft Corporation of Ypsilanti, Michigan, to specifications calling for features of safety, ease of operation and simplicity of construction that the Bureau seeks in an airplane for private owners. The airplanes will be used by aeronautical inspectors making their regular trips throughout the United States in connection with licensing and regulation activities.

Aircraft Sales

AMONG THE aircraft sales recently announced is an order from Braniff Airways, Dallas, Tex., calling for seven Lockheed Electras for use in an extended service over the company's routes. The planes will be equipped with every modern device for flight, including radio receiving and sending sets.

Another quantity order was filled by Taylor Aircraft Corp., of Bradford, Pa., when it shipped four Cubs to its Memphis distributor, Southern Air Service, Inc., which resold one to A. B. Silson of Joiner, Ark. Another Taylor Cub was purchased by the Little Rock, Ark. Flying Club which is operating from the local municipal airport.

Porterfield Aircraft Corp. sold two planes for export purposes, one going to Renato P. Pedroso of Sao Paulo, Brazil, and the other being flown away from the factory by Charles C. Baughan of Mexico City. A new Ryan S-T low-wing monoplane has been purchased by the Ryan School of Aeronautics, Lindbergh Field, San Diego, Calif., and a Fairchild 24, equipped with Edo floats, has been shipped to Darke Mattos of Rio de Janeiro. Tri-American Aviation, Inc., made the sale.

Monte Barnes, test pilot for the Beech Aircraft Corp., Wichita, Kans., sailed for France with a Beechcraft B17L for Maurice Salle of Paris. At the same time, another Beechcraft was placed aboard the steamer for delivery to Amy Mollison.

Evans Motors, automobile dealers operating in a number of southeastern states has been appointed distributor for Monocoupe in that territory.

(Continued on following page)

Digest of Recent Events

29,000-Mile Flight Completed In New York

SPENDING 290 hours in the air, during which they flew 29,000 miles and took 600 or more photos of various points of interest, Dr. Richard Upjohn Light and Robert Wilson completed their flight which took them around the world by landing their Bellanca at College Point, Long Island, N. Y. The men left on August 20, and proceeded north to Greenland, Iceland, the Faroe Islands before crossing to Europe from where they flew to Asia. At Manila they shipped their plane to Vancouver where they reassembled it and flew to San Francisco, Los Angeles and San Diego before returning to New York. JAN. 25

French Woman Flyer Sets Altitude Record

MADELEIN CHARNAUX set a new altitude mark for women in the light plane category by flying a Farman monoplane to 20,172 feet over the Orly Airdrome. JAN. 29

Richman Sets New Record For Amphibions

FLYING AT an average speed of 100.5 miles an hour over a 1000-kilometer course at Miami, Fla., Harry Richman, accompanied by George Daufkirk, set a speed record for amphibion cabin planes. Richman was the first pilot to set such a mark, since there has never been an official recognition of a plane of that category by the F.A.I. Officials of the NAA timed the flight in the event the international body plans to homologate it. FEB. 10

Macon Destroyed By Broken Fin

THE U.S.S. *Macon*, Navy dirigible, was lost when she landed in the water off the California coast near Point Sur while on maneuvers with the fleet. At a court of inquiry held subsequent to the loss, it was ascertained that the fin broke causing the ship to go out of control and causing the downward descent that ended in the water. Only two lives were lost, most of the men being picked up by Navy vessels which were in the vicinity. FEB. 12

Transport Makes Fast Flight From Miami

CLIPPING AN hour from the best previous time, an Eastern Air Lines Douglas flew from Miami to New York City in 5 hours 34 minutes with 13 passengers, maintaining an average of 215 miles an hour for the 1200-mile flight. The elapsed time for the flight was 6 hours 9 minutes and the pilots were Don Johnson and John Battle. FEB. 17

Rossi and Codos Fly 3100 Miles

ALTHOUGH BALKED in their attempt to shatter their own distance record of 5,653 miles, Paul Codos and Maurice Rossi flew from Istres Airdrome to Porto Praia, Cape Verde Islands, a distance of 3100 miles where they were forced to land due to oil trouble in the engine of their *Joseph LeBrix* monoplane. They announced their intention of flying from Istres to Buenos Aires, 6,830 miles just as soon as they return to France where they will overhaul their plane. FEB. 17

Post Reaches 300 m.p.h. Speed in Stratosphere

A TWO-HOUR test flight in preparation for his projected coast-to-coast stratosphere flight indicated that Wiley Post will make the flight in about 8 hours, or less. In these tests, Post attained a speed of more than 300 miles an hour at 28,000 feet, but said that more could be obtained by extending his engine. FEB. 17

Andrews Flies Coasts in 11½ Hours

AVERAGING 218 m.p.h., Leland S. Andrews flew a Cyclone-powered Vultee from Burbank, Calif., to Floyd Bennett Field, Brooklyn, N. Y., in 11 hours 34 minutes to set a new record for transport planes. H. Meyers, co-pilot, and G. D. Rayburn, radio operator, accompanied him on the flight. FEB. 21

DISTRIBUTORS Give Quick Approval!

To a private owner, this means sure satisfaction, for airplane distributors depend on the quality of the ship they sell to bring in bread and butter!

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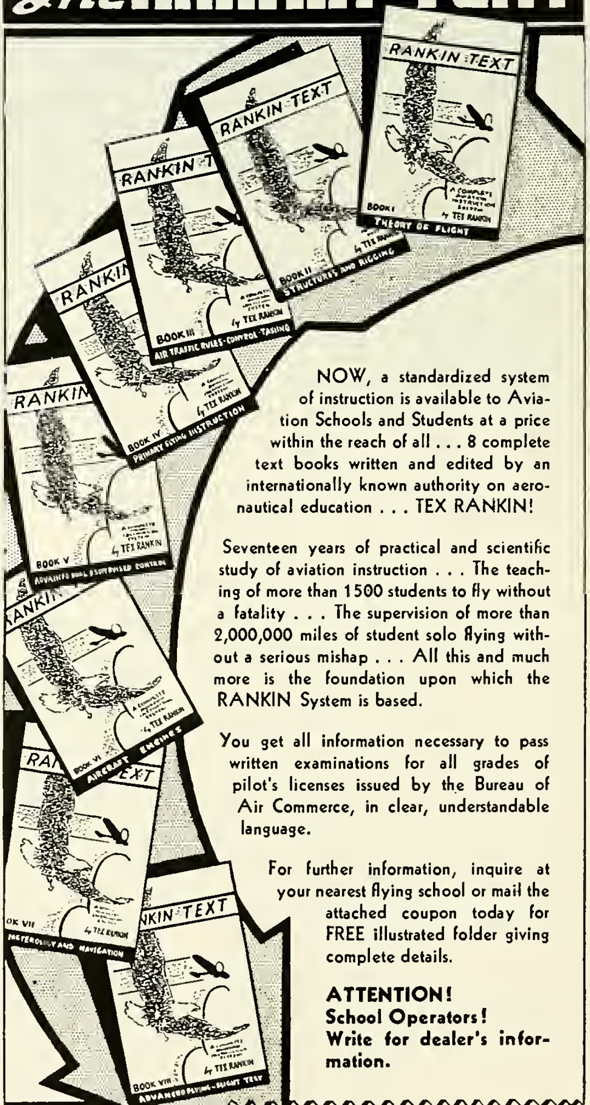
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(Continued from preceding page)

Personnel Changes

CHARLES H. CHATFIELD, chairman of the technical advisory committee of United Aircraft Corp., has been elected vice-president of the Society of Automotive Engineers covering the field of Aircraft Engineering. The election automatically places Chatfield as chairman of the Aircraft Activity Committee and a member of the governing council of the Society. Eugene E. Wilson, president of the Chance Vought Corp., subsidiary of the United Aircraft Corp., who himself recently was elected vice-president of the Institute of Aeronautical Sciences, announced the appointment of Joseph M. Barr as chief inspector of the company, succeeding T. A. Murphy who was transferred to the Sikorsky Aviation Corp., as factory manager. Norman V. Clements was appointed advertising manager of the Chance Vought Corp. at the same time. Another appointment affecting the Sikorsky company was that of Geo. E. Cerveny, formerly of the Douglas Aircraft Corp., as resident inspector and acceptance pilot for Inter-Island Airways, Hawaii, which is reported to have ordered two new S-43 amphibions.

Two new additions to the staff of the Fairchild Aerial Camera Corp., were announced by C. A. Harrison, sales manager. They are Don P. Wilson, and Burnham Litchfield. At the Glenn L. Martin Company three new directors were appointed including John K. Shaw, Otis A. Glazebrook, and Silliman Evans, formerly fourth Assistant Postmaster General and at one time with the Aviation Corp.

Russell W. DeLany, aeronautical inspector for the Bureau of Air Commerce at Love Field, Dallas, since 1929 has been transferred to Kansas City as airline inspector, and W. F. Gradolph was elevated to the position of vice-president in charge of sales for the DeVilbiss Company.

Jessel S. Whyte, vice-president and general manager of the Macwhyte Co., Kenosha, Wisc., manufacturers of wire rope and aircraft tie rods, was elected to the Board of Governors of the N.A.A.

The E. I. duPont de Nemours & Co., of Wilmington, Del., announced that Howard Ketcham has opened an office in New York, N. Y., where he will specialize in commercial phases of color in industry. Mr. Ketcham is continuing his work for the duPont interests as a color consultant specializing in promoting the correct relationship between product and market.

K. S. Lindsay, formerly operations manager at Roosevelt Field, has joined the B. G. Corporation, New York manufacturers of aircraft spark plugs.

In recognition of six and a half years of continuous service in the engineering department of the Lockheed Aircraft Corp., Burbank, Calif., James M. Gerschler has been appointed assistant engineer by Hall L. Hibbard vice-president and chief engineer. Gerschler has contributed much toward the design of the Sirius, Orion, Altair and Electra.

The appointment of Frank C. Mock, as vice-president in charge of carburetor engineering of the Bendix Products Corp., South Bend, Ind., was recently announced by Vincent Bendix.

Bureau Approves "T" Antenna

THE BUREAU of Air Commerce, Department of Commerce has found that a vertical *T*-shaped aircraft radio antenna three feet high is one of the most suitable types for use in "flying the beam" of the radio range directional beacons on the Federal Airways System.

Final conclusions from a study of various types of antennas and their effect on the reception of the radio beam were that a *T* antenna with an actual vertical height of about three feet is equivalent to a five-foot vertical mast; that if installed longitudinally above or below the fuselage it will receive the signals accurately; that it should be less susceptible to trouble from ice formation than other types; and that it should create very little aerodynamic drag.

COMING EVENTS

Group and regional meetings of the American Society for Testing Materials will be held in Philadelphia, Pa. March 4-8

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Organization conference of the Sportsman Pilot's Association at the Mayflower Hotel, Washington, D. C. March 8-9

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Entries for the Sixth Annual William E. Boeing Scholarships, held by the Boeing School of Aeronautics, Oakland, Calif., close. March 15

•

Final examinations for Air Corps appointments will be held by the War Department. April 2

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The First National Intercollegiate Flying Conference is to be held in Washington, D. C., under the auspices of the N.A.A. April 2-3

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The Intercollegiate Flying Club Air Meet will be held at the Municipal Airport, Northampton, Mass. May 4

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The Thirty-eighth Annual Meeting of the American Society for Testing Materials will be held at the Book-Cadillac Hotel, Detroit, Mich. June 24-28

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The Sixth Annual National Soaring Contest will be held at Elmira, N. Y. June 29-July 14

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An 18,500-mile International Air Race will be held along the coast line of North and South America, in October, 1935

Industry Contracts for Materials

ENGINEERS FROM Pan American Airways have been in conference with S. F. Bowser & Co., manufacturers of airport gasoline equipment at Ft. Wayne, Ind., over proposed high-speed fueling systems for use at projected refueling depots on the trans-pacific service now being contemplated. Plans call for the use of a 2-cylinder gasoline engine to furnish power to force the gasoline from storage tanks, underground to fueling pits, and through the hose to the planes.

Pan American Airways also ordered two Caterpillar Diesel Forty Tractors and four power units for use on the Midway Islands and Wake Island over the proposed trans-pacific route.

Gould Storage Battery Corp., of Depew, N. Y., received contracts from the Government totalling more than $25,000 for batteries to be used in various types of aircraft service. These batteries, of lightweight construction, utilize the Kathanode Retrainer Mat to protect the plates against wear and increase their life and performance, and feature acid-tight seals which allow fumes and gas to escape while the battery is in operation but prevent leakage of acid when the plane is flying in an inverted position.

Tom Colby, of Berry Brothers, Detroit, Mich., reports that the new Zinc Chromate Primer (described in the January 1935 issue of Aero Digest) is now used regularly by six aircraft manufacturers for both military and commercial aircraft. Known as P-27, this product was developed by Berry Brothers to meet the Navy's requirements for aircraft finishes. It also meets Army specifications.

Plane Carries Auto on Flight

A FULL size automobile suspended between the wheels of the landing gear of the twin-engined Uppercu-Burnelli transport was carried to an altitude of more than 5000 feet over the Floyd Bennett Municipal Airport in Brooklyn, N. Y.

The test was held by officials of the Sun Oil Co., to prove that aircraft could be used to transport motor vehicles such as ambulances, officers' cars, tractors and other equipment.

Lou Reichers flew the plane.

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FOREIGN NEWS IN BRIEF

●

Australasia

PUBLIC AID in the form of about $40,000 has been provided for the upkeep of the Penang Flying Club and the purchase of additional equipment. An instructor has been engaged and three new-type planes have been ordered from England. A further aid to the development of civil aviation in the Straits Settlements is evidenced in the appointment of Mr. K. Robertson as British Civil Aviation Directorate Representative for Malaya.

THE SHELL Co., of Australia, Ltd., has purchased a new deHavilland *Dragon Rapide* for testing new fuels and lubricants. The machine is equipped with 6 chairs, and in addition to special fittings, has an insulated cabin to reduce noise.

NEW ENGLAND Airways, Ltd., has taken over the service between Sydney and Newcastle, formerly operated by Northern Air Lines, Ltd.

A NEW aviation company, operated by Major E. G. Clerk, has been established in Brisbane. The company will use a Fairey III, two single-engined Avros, and a three-place Spartan in its operations.

WILFRED KINGSFORD-SMITH, a brother of Sir Charles, is planning to inaugurate air service between Sydney, Goulburn, Young and Cowra. A tri-weekly service is contemplated with four passenger Monospar low-wing monoplanes.

NORMAN TURNER has added a new Waco cabin plane to the fleet of three Wacos already owned by his company, East African Airways, Ltd., Nairobi. This company holds leases on several airports in Kenya where it operates repair depots and charter services and is also contemplating experimental airline-operation between Nairobi and Kisumu.

THE SEVENTH government to acquire the right to fit Handley Page slotted wings to aircraft used and ordered by them is New Zealand. The other governments that have already concluded agreements are Great Britain, France, India, the United States, Sweden and Finland. In Canada and Italy the rights are owned by companies formed specially to handle the invention, and in Japan a private company owns the naval rights. In no fewer than thirty-four other countries the slotted wing is used extensively on military and civil planes.

Canada

THE OUTSTANDING fact reflected in the statistics covering Canadian Airways operations from January 1 to December 31, 1934, is the increase in poundage of air express. From a total of 764,449 pounds (382 tons) in 1931, each succeeding year has shown a steady progression in express tonnage carried by plane. From 1934, the impressive total of 5,766,691 pounds (2883 tons) was reached, and in addition, 1,591,765 miles were flown in 16,993 hours with 472,308 pounds of mail and 16,594 passengers.

These figures indicate increasing recognition of the facilities provided by air transportation in areas that lack adequate ground transport, or in which ground transport is too slow. Indirectly they afford evidence of the present activity in northern mining development. It is recognized that today air transportation is essential to industrial development in the north. Moreover, the efforts being put forth by the air transport companies are not being dissipated in unproductive competition with optional methods of transport, but are being applied directly to a field of endeavor which demands qualities that the airplane alone can provide.

This is further emphasized by the fact that nearly 80 per cent of this express was carried into that hitherto undeveloped territory which lies north and west of the Great Lakes—Western Ontario, Manitoba and the North West Territories.

The work of the air transport companies in the north is essentially the transportation of machinery, supplies, foodstuffs, and prospectors, miners and other travelers. Machine units weighing from 1,000 to 1,200 pounds are accepted as a matter of course as ordinary cargo, limitations being imposed more by dimensions than by weight. This fact is becoming better known to the manufacturers of mining machinery, who are sectionalizing their units to facilitate loading.

Air mail services in Canada are limited entirely to the mining areas and to remote points which lack speedy ground transport. Since the discontinuance of the Prairie Air Mail service in 1931, these auxiliary services have shown a steady increase in poundage.

IF THE proposed plans for the Sea Island air base in Vancouver are carried out, the city will boast one of the finest land and seaplane bases on the continent. Airport Manager William Templeton has suggested that a new entrance road be constructed, the main runway extended, additional acreage purchased and improved, a hangar and workshops erected and improvements rendered on the proposed seaplane lagoon. The work will cost about $500,000 and would take 5 years to complete.

PIONEER AIRWAYS, Ltd., has been organized in Ocean Falls, B. C., by a syndicate of business men to conduct a charter and fixed base operating business. Following the appointment of W. R. McCluskey as general manager, the company purchased a P. & W. Wasp-powered flying boat from Boeing Aircraft of Canada, Ltd., for use in passenger and freight carrying, and photography.

SEVENTY-FIVE thousand dollars worth of furs, the largest single-day shipment in the history of Canadian Airways recently arrived in Ft. McMurray, being brought in by five planes operating in the company's northern service. The furs were packed in 75 bales; they weighed 2900 lbs. and were flown from points as far as 1465 miles away.

(*Continued on following page*)

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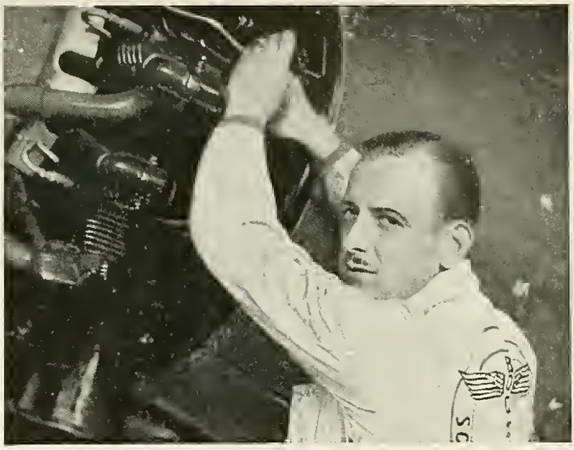

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(*Continued from preceding page*)

MINING CAMPS and territories north of the railway line in Canada are now serviced with air mail. Four inaugural flights were made recently. The first, flown by Canadian Airways, Ltd., operates out of Winnipeg to Bissett, Wadhope, Beresford Lake and Diana; from Kenora to Red Lake and Mackenzie Island; and from Sioux Lookout to Casummit Lake.

Another route extends from Kenora to Whitefish Bay in Ontario near the Manitoba boundary. This run is also operated by Canadian Airways. General Airways now operates the air mail route in northern Quebec (Siscoe to Val d'Or and Bourlamaque), while Canadian Airways has the contract on the run from Winnipeg, Norway House and Gods Lake.

While intercity air mail is at a standstill in Canada, there has been an expansion of air mail routes into the northern regions. There is no air mail stamp charge, the regular first class postage rates prevailing for letters.

FOUR LANDING fields and a radio station are being planned for the New Brunswick section of the trans-Canada airway, which it is hoped will be completed this year and will be available for use in the near future. The fields in New Brunswick, spaced 30 miles apart, will be at Brockway, Blissville, Cambridge and Havelock. The proposed radio station is expected to be erected at the site chosen for a field at Fredericton.

THE JUNIOR Chamber of Civic Affairs of Vancouver is sponsoring a series of radio broadcasts to promote aviation. The Aero Club of British Columbia is cooperating in the program.

Great Britain

ANTHONY H. R. FEDDEN, chief engineer of the aero engine department of the Bristol company, has been awarded the Simms Gold Medal of the Institution of Automobile Engineers for his recent paper on the development of air-cooled engines. This medal is awarded, annually if possible, to a British subject for an invention, improvement, design, paper or lecture, or research of outstanding merit in connection with internal combustion engines.

A NEW Short Brothers four-engined airliner is expected to take the air this spring. It is a high-wing monoplane, with the four 90-h.p. Niagara air-cooled engines set on the underside of the wings, two on either side of the fuselage. With full load, the craft will be able to continue flight indefinitely with any one engine stopped. The cabin will be arranged to seat ten passengers and for short trips, the lavatory structure at the aft end of the salon can be removed and two more passengers accommodated.

The estimated maximum level speed of the plane is 138 m.p.h., and its normal cruising speed 120 m.p.h. Initial rate of climb, with the craft laden to the maximum permissible gross weight of 5,640 pounds, is expected to be 725 ft./min. Still-air range at cruising speed is estimated at 400 miles. The fuel consumption is expected to be 17 gallons an hour, or seven miles to the gallon.

A NEW record in the weight of letters sent from Great Britain to other countries by air was established during 1934, when 122 tons, an increase of 43 per cent over 1933, were carried. On the Empire airlines alone 143,700 lbs. of mails were sent in 1934 as against 98,100 lbs. in 1933. Estimates show that almost 6 million letters were carried by plane during 1934 compared with 4 million previously.

R. A. F. SQUADRONS are being re-equipped with more modern aircraft, and the re-equipment program is to be continued until all units have the latest available in aircraft.

Among the new types being delivered are the Gloster *Gauntlet*, one-place fighters with a reported maximum speed of 230 m.p.h.; the Blackburn *Shark* torpedo bomber land or seaplane with folding wings; and the Handley Page *Heyford* night bombers which possess high speed servicing and arming features.

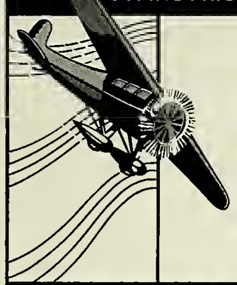
IMPERIAL AIRWAYS' new feeder plane built by Boulton Paul has been delivered and is undergoing tests at Croydon Aerodrome. The plane is a biplane powered by two Siddeley *Jaguar* engines of 460 h.p. each. Features are quick take-off, high rate of climb and a short landing run, together with a cruising speed of 145-150 m.p.h. at 4500 ft. Streamlining has been carried out by fairing the engine nacelles in the upper wing, equipping the engines with Townend rings and enclosing the landing wheels in "pants," and by filleting the junctions of struts and wires with wings or fuselage.

THE FEDERATION Aeronautique Internationale has homologated and added to its record categories, the Scott-Black flight of 71 hours 18 seconds between England and Australia. This inaugurates a new category of world's records and will be listed under a "capital to capital" record.

ANOTHER ADDITION to the Bristol Aeroplane Company, Ltd., factory in Bristol has provided 28,000 square feet of space to the engine department, giving about 25 per cent more machinery capacity, and allowing further increase in engine output.

HIGH SPEED and economy are evidenced in the design of the new Airspeed *Envoy* twin-engined monoplane which recently made its first flights. The ship is of the low-wing type with a semi-retractable undercarriage that permits part of the wheels to protrude from the wings when the landing gear is fully withdrawn. It is powered by 240-h.p. Siddeley *Lynx* air-cooled, radial engines and can carry a pilot, eight passengers, baggage and fuel for 250 miles non-stop at a maximum level speed of 175 m.p.h. Its normal cruising speed is 153 m.p.h. Trials show that the machine can be flown under complete control, with full load on either engine.

(*Continued on following page*)



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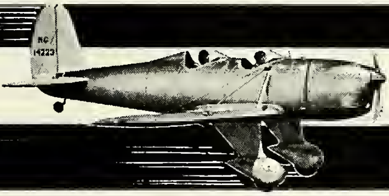

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(Continued from preceding page)

Germany

A SECOND South Atlantic floating station was established by outfitting the motor ship *Schwabenland* to serve as a relay and refuelling vessel in mid-Atlantic for the Deutsche Luft Hansa's air mail service between Germany and South America. It will be used in cooperation with the *Westfalen* which has been in commission since February, 1934, and has enabled the Luft Hansa since that time to complete 22 transatlantic flights, carrying 20,000 letters. The *Schwabenland* is an improvement over the *Westfalen* in that it is equipped with two Diesel engines of 1,800 h.p., each and the airplane catapult is at the stern instead of in the bow. The *Schwabenland* has two special platforms for parking seaplanes.

Italy

ITALY AND Great Britain have tentatively agreed upon a plan which will enable transport craft from either country to fly over the possessions of the other. Accordingly, British transport planes will be able to fly over Italy and may use the airports at Milan, Rimini and Rome. Italian transports may fly over and land at Gibraltar, Malta, Apro, Aden, English Somaliland and Palestine.

ALA LITTORIA is offering round-trip excursion flights between Rome and Tripoli at a 50 per cent reduction over regular rates. A five-day stop-over at either terminus is being permitted to the groups of three or more who purchase these tickets.

FIAT IS developing a new high-speed, all-metal, low-wing bi-motored transport. Known as the G18, the plane will carry 18 persons at a maximum speed of 205 m.p.h., and a cruising speed of 180 m.p.h. Two Fiat A59-R engines of 700 h.p. each will be used.

GENERAL PIETRO OPIZZI has been appointed president of the Royal Aero Club of Italy, according to the Chief of Aeronautics of the Italian Ministry.

MORE THAN 900,000 persons visited the Italian Aeronautical Exposition which was held in the Palace of Arts in Milan for 198 days. Sixteen thousand visitors came from foreign countries and the receipts amounted to 6 million lire.

Mexico

ISOLATED COMMUNITIES in the high Sierras of Chihuahua and Durango will have an aerial service shortly when Daniel P. Fort, who holds a federal permit to operate the airway begins operations. The line will serve seven mountain mining towns. Passengers and express will be carried at first, but mail service will be added later.

TWELVE MEMBERS of the army aviation corps and two doctors attached to it were sent abroad last year for specialized training and study, according to the War Department's aeronautical section. Eight pilots are at a San Antonio, Tex., training field; two others are at Camp Maxwell, Montgomery, Ala.; a lieutenant mechanic is learning aircraft construction in Los Angeles, and a pilot is a student at a Spanish flying school. The doctors are abroad studying advanced methods for examining pilots.

AEROVIAS CENTRALES has put into service six Lockheed-Electras powered by two P. & W. Wasp 525 h.p. engines, on its Mexico City - El Paso-Los Angeles route. These planes have reduced the flying time between Mexico City and Los Angeles to 7 hours 5 minutes.

AIR SERVICE between Mexico City and Acapulco, carrying passengers and express, has been inaugurated by Aeronaves de Mexico, S. A., with a daily schedule each way. Acapulco is a seaport on the west coast of Mexico and two American single-engined transport planes for 4 and 6 passengers, respectively, have been put on the service to make the non-stop trip in 1 hour 40 minutes. One-way passenger fare is $8.33.

ESTABLISHMENT OF local air mail routes ranging from 300 to 500 miles each, to serve isolated communities where land or sea transportation services are infrequent or inadequate, will be undertaken by the Ministry of Communications and Public Works.

A NEW law governing civil aviation fees establishes the following tariffs: Technical inspection of planes for license, $14; medical examinations for pilots and granting licenses for pilots of all classes and for renewing transport pilots' licenses, $2.80. No charge is made for renewing the licenses of pilots of private or tourist planes.

South America

A NEW South American altitude record was established at the Cordoba Airdrome, Buenos Aires, when Captain Raul Sola, an Argentine Army pilot, rose to 29,540 feet in a Curtiss *Hawk* with a Wright Cyclone engine. The record altitude was attained 42 minutes after take-off, and Capt. Sola used Stanavo gasoline, aviation oil and rocker arm grease.

USE OF the power of eminent domain for land for airport construction in Costa Rica was authorized by a recent legislative decree. Under its terms, lands deemed necessary for airport construction may be declared of public utility and after being expropriated will belong to the respective municipalities in which they are located. The municipalities will be obliged to prepare and maintain them as airports and may charge private air transport lines for their use.

THREE OR possibly more landing fields will soon be dedicated in San Salvador. Santa Ana, second largest city, has almost completed one airport; La-Union is rushing work on another; and Sensuntepeque is progressing rapidly on its project.

TRANSPORTES AEREOS Salvadorenos is ordering another transport plane to meet its increasing traffic demands. It is now operating two Bellancas, and with the opening of additional routes needs a third plane, which probably will be another Bellanca.

Russia

A COMMERCIAL dirigible line will be opened in the near future covering a 1000-mile route between Moscow and Sverdlovsk, in Central Asia. The ships will be of 18,500 cu. m., of the semi-rigid type capable of transporting 18 passengers and mail on a schedule service. Power will be supplied by three 250 h.p. engines, and the flights will be on a non-stop basis.

Spain

LINEAS AEREAS Postales Espanolas, the Spanish air transport combine has taken delivery of a de Havilland *Dragon-Rapide* twin-engined biplane which will be used to carry mail and passengers in Spain and North Africa. This is the first plane of this type acquired by the Spanish company and brings the number of Rapides sold in seven months up to 23.

Sweden

CONTROL OF Aerotransport, operating to Finland and through Sweden, was acquired by A/B/ Rederi Svea (Shipping Company Svea) by the purchase of a majority of the stock. The remaining stock is held by industrial enterprises interested in air traffic.

PLANS FOR an international aeronautical exposition to be held in Stockholm in the summer of 1936 have been inaugurated. The Broma airport near the city is expected to be opened during the show and it is anticipated that high-speed non-stop service between Stockholm and London and Paris will be started at that time.

ADVERTISERS' LITERATURE SERVICE

IMPORTANT

The literature of these advertisers is available only to those who are in the market for any of the products or facilities advertised in this issue. Read carefully, before filling out the coupon, the advertising of the items in which you are interested. Be sure to mention the company with which you are associated, and your position.

AIRCRAFT

Literature available to dealers, operators, business houses, potential plane owners:

1. AERONCA — Two place; monoplane; less than $2,000 .... Page 61

2. FLYABOUT — Aircraft Mechanics, Inc., two place cabin monoplane, less than $2,000 .... Page 55

3. BEECH—High performance, cabin biplane, four passengers. .... Page 57

4. FAIRCHILD — An attractive line of open and closed cabin monoplanes .... Page 1

5. LAMBERT—High performance, two place cabin monoplanes .... Page 65

6. RYAN—One of the newest; two place open, metal sport monoplanes .... Page 67

7. TAYLOR— Two place monoplane, less than $2,000. Page 63

8. UNITED—Used Boeing aircraft, several different types, all in excellent condition. . Page 72

Literature available to airline officials and military authorities:

9. BOEING — High speed, all metal passenger, mail and express aircraft; twin engined .... Page 33

10. GRUMMAN — High performance, single engined land planes and seaplanes for U. S. Navy and Coast Guard. . Page 6

11. NORTHROP — Single engine, high speed, all metal cabin aircraft for airline service .... Page 10

ENGINES

Literature available to manufacturers, operators, military authorities, engineers—here and abroad:

12. P & W—Wasp and Hornet series; direct drive, geared, supercharged .... Back Cover

AIRCRAFT & ENGINE EQUIPMENT

Literature available to members of the aircraft industry, plane owners, etc.:

13. AIR ASSOCIATES — Showing a complete stock of Berry Bros. finishes; other aircraft and pilot supplies .... Page 45

14. AERONAUTICAL RADIO — Exclusive representative, Roosevelt Field, for Western Electric radio...... Page 70

15. BERRY BROS.—Announce a new Zinc Chromate Primer; other finishing materials Page 43

16. B. G.—Regular and shielded mica aviation spark plugs. Page 2

17. ECLIPSE—Engine starters, generators, landing gear motors, etc. .... Second Cover

18. EVANS — Fuel pumps; spring loaded flexible sylphon seal, flexible shaft, integral relief valve, wabble pump by-pass .... Page 57

19. FAIRCHILD—Kruesi Radio Compass for transport lines, commercial operators, private fliers .... Page 55

20. FLEETWINGS—"Shotweld" stainless steel construction; stainless steel gas tanks, etc. .... Page 57

21. GOODRICH—"Silvertown" airplane tires; other rubber products for aircraft ...... Page 23

22. GOVRO-NELSON — Precision machine work on engine, plane and accessory parts .... Page 63

23. GLIDDEN—Glidair Fabricote for aircraft refinishing; varnishes, lacquers, dope, etc. .... Page 67

24. H-S — Hamilton Standard Controllable Pitch Propellers for 200 h.p. up.......... Page 29

25. KOLLSMAN—Precision aircraft instruments; individual indirect lighting, clamp type mounting .... Page 3

26. LEAR—New Radio Compass Direction Finder; covers airway beacon and broadcast channels .... Page 63

27. MACWHYTE—Streamline, square, round tie rods, aircraft cable, slings .... Page 67

28. N-B — Nicholas-Beazley, aircraft supply house, introduces a new oil heater for aircraft and a new retractable landing light .... Page 8

29. NATIONAL—Aircraft tubing, to meet U. S. Army and Navy specifications.... Page 37

30. NORMA-HOFFMANN — Precision bearings for aircraft, engines, accessories and other aeronautical products. . Page 39

45. RCA—Complete line of aircraft and airport receivers and transmitters .... Page 53

31. THOMPSON—Intake and exhaust valves, standard equipment on the majority of aircraft engines .... Third Cover

32. BA-30—Wellington Sears Grade A aircraft fabric, to Army and Navy specifications. Page 65

33. S. S. WHITE — Flexible drive shafts for tachometers, fuel pumps, remote radio control; molded resistors for radio and electronic equipment... Page 75

MISCELLANEOUS

Literature available to members of aviation industry and others interested in the products or services advertised:

34. RANKIN — The Rankin Text, a series of booklets outlining The Rankin System of Ground School and Flight instruction .... Page 61

35. RONALD — The Ronald Press library contains 28 technical and non-technical aviation books for students, pilots, mechanics, engineers..... Page 80

SCHOOLS

Literature available to everyone planning training in any of the courses advertised (See Aviation Schools Department for additional school advertising):

36. AERO. UNIVERSITY — Chicago; Aero engineering, mechanics, administration courses, etc. .... Page 56

37. BOEING—Oakland, Calif.; All grades pilot licenses, mechanics, airline operations courses .... Page 63

38. C-W TECH — Glendale, Calif. Aero engineering, mechanics, drafting...... Page 49

39. DALLAS — Dallas, Texas. All grade pilots and mechanics, radio courses.......... Page 7

40. CASEY JONES — Newark, N. J. Aero engineering, mechanics, blind flying courses .... Page 67

41. PARKS—East St. Louis, Ill. All grades pilots and mechanics courses .... Page 5

42. RYAN—San Diego, Calif. Pilots and mechanics courses, aerial navigation .... Page 9

43. ROOSEVELT — Mineola, N. Y. All grades pilots and mechanics courses, aerial navigation .... Page 70

44. SPARTAN — Tulsa, Okla. Flying, mechanics, radio, instrument, management courses .... Page 55

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FUTURE OF AIR WARFARE

(*Continued from page 17*)

only in the production of new ships, but also in the repair of those damaged in sea battles. Furthermore, as money is one of the chief munitions of war, it is not unreasonable to assume that our large financial centers, such as New York, would be thoroughly bombarded, not only to insure disruption of ordinary business, but also to bring personal pressure to bear on the financial interests.—and bankers scare very easily, as do politicians, which leads to the conclusion that Washington would be a favorite target for explosive, toxic, and incendiary bombs. New York City, of course, would have to be evacuated by the civilian population, because the reservoirs which hold the city water supply easily could be bombed, the dams wrecked, and the water dissipated. Without water, New York would be a pest-hole within a week.

But, what, you may ask, would Army and Navy pursuit ships be doing all this while? The answer is that the airplane is not a defensive weapon; it is an offensive weapon. It can be used effectively in defense of a nation only when used as a weapon of offense against ground objectives of other nations. As General Douhet writes, "The nation which adopts the offensive has the advantage of choosing its objectives and of being able to concentrate all its forces at the point of attack. The adversary, who does not know at what point he will be attacked, must disperse his forces and await this attack." Thus the United States, expecting attack by an Air Force, must spread out its pursuit squadrons in the vicinity of several possible enemy objectives. And if the enemy attacks in overwhelming force at any one of those possible points, the pursuit ships detailed for defense will be outnumbered and destroyed. Furthermore, as the defense cannot know the objective selected nor the time of attack, it will have to wait until definite information is received—for aircraft cannot stay in the air indefinitely—and by the time the pursuit ships get up and come to grips with the bombers, the bombers' objective may have been attained. Besides, locating bombers at night, even with the aid of batteries of searchlights, is a difficult task; anti-aircraft guns are not very effective; and it is not too much to say that night bombing is impossible to ward off. The United States, incidentally, has very few pursuit ships capable of catching a modern bomber, or of shooting it down if by chance they did catch up with it.

What, then, is to be done? The answer is to do unto others as they would do unto you; and if possible do it first. If they can bomb you, then you, if you have the right equipment, can bomb them. *There is no other defense against air bombing,* anti-aircraft people and pursuit pilots to the contrary notwithstanding. But, you say, what about the Navy? Other nations have navies; if they have an Air Force as well—as some have—their combined Air Force and Navy is superior to our Navy and its auxiliary aviation. Besides, we usually have only half of our navy on one coast at one time; and if an enemy bombards and partially destroys the Panama Canal, our half a navy will quite possibly be defeated while the other half is steaming forlornly around Cape Horn. War has a habit of playing very mean tricks on nations.

The United States may be attacked by ship-borne aircraft or by aircraft based in Canada or Mexico. If an Air Force and its sea carriers, convoyed by an enemy navy or navies, should engage the air auxiliaries of our own half a navy, the advantage would lie with the attackers; for obviously they would not even contemplate an attack on our cities if they did not possess the power to overwhelm the fringe of aerial defense we should be able to throw against them at sea. Thus our auxiliary naval aviation on one coast could be destroyed—of course at the cost of great loss to the enemy—and the work of our surface fleets would be seriously hampered. It is also possible to approach our coasts undetected. The only defense against an Air Force at sea is another Air Force, not to fight it, but to bombard the carrier ships on which it berths and the fleet of which the carriers form a part.

REVIEWS of BOOKS

ELEMENTARY AERODYNAMICS

By Wood and Wheatley

• A TEXT used as a non-mathematical introduction to the more technical work connected with advanced aerodynamics and airplane design. Written primarily for the student pilot, it includes (in appendix form) NACA Rept. 474 which is the latest approved list of definitions and nomenclature, suggestions as to flying technique, methods of flight instruction and an outline of the history of aviation.

Published by the Cornell Co-op Society, Ithaca, N. Y., it is prepared in mimeographed and lithograph form similar to the two other works by Wood. It contains 180 pages of information and 150 illustrations.

CYCLONE OVERHAUL MANUAL

• WRIGHT AERONAUTICAL Corp., has just prepared an extensive overhaul manual for Wright Cyclone engines, which should find a definite place in every overhaul and maintenance shop.

Complete unto the minutest detail, this manual should make overhaul procedure an easier and more efficient task. The practices described therein, as applied to the "F" series Cyclones, when followed, insure the utmost in engine performance.

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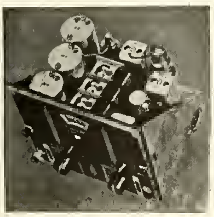

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TRADE LITERATURE

Unit Heaters

• BULLETIN 527 issued by the Fedders Manufacturing Co., Buffalo, N. Y., contains illustrative and descriptive material on the new Series 3 Unit Heaters produced by this organization.

Listing nine operating advantages, the pages also relate the engineering and design features of the unit being considered. Useful in hangars, offices and shops, the new heaters are made up of four major parts, are attractive and provide even steam distribution in capacities up to 1200 sq. ft. EDR. A typical piping diagram for the heater is interesting and informative.

Stainless Steel

• AMERICAN ROLLING Mill Co., which maintains executive offices in Middletown, Ohio, and branch offices in 14 principal cities has issued a new 4-page brochure called *Fine Finishes.*

The information contained therein is brief albeit adequate enough to tell of the properties of Armco 18-8 and Armco 17 steels. Thirteen facts concerning each are given as are informative paragraphs on the cost savings, sales appeal, sanitation and appearance of these products.

Sperry Pilot

• A VERY absorbing topic is made even more interesting by the Sperry Gyroscope Co., Inc., of New York, N. Y., in the *Sperry Pilot For Automatic Flying.* Similar in appearance and presentation to the good-looking booklets usually gotten up by this company, this newest contribution gives complete and illustrated information on the Gyroscope; the use and operation of the "pilot"; and its advantages to the airplane pilot.

Aviation Activities

• SOCONY-VACUUM Oil Co., Inc., is publishing as a house organ a magazine called *RPM* which contains some interesting items on world-wide aviation activities and even more interesting photographs of aviation events, etc.

Volume 1, Number 2 has readable and well-illustrated items on TWA's overnight coast-to-coast service, a new aviation oil, the Series F Wright Cyclone engine, American Airlines' sleeper-plane service and an interesting article on instrument flying.

Man-Made Rubber

• PERSONS INTERESTED in synthetic products that are just as good as (or superior to) the genuine should find the booklet *DuPrene* exceptionally interesting. It is the story of man-made rubber from the Rubber Chemicals Division of E. I. duPont de Nemours & Co., of Wilmington, Del.

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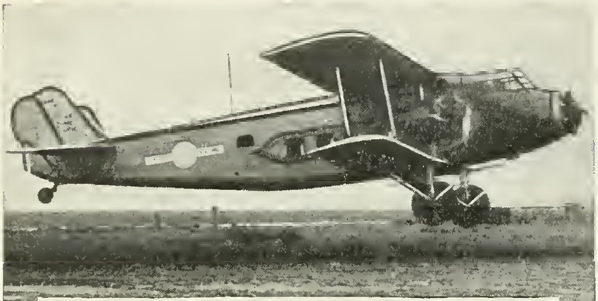

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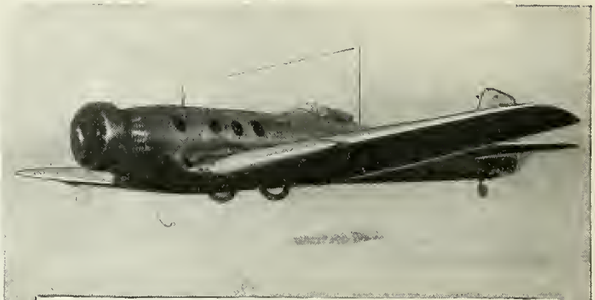

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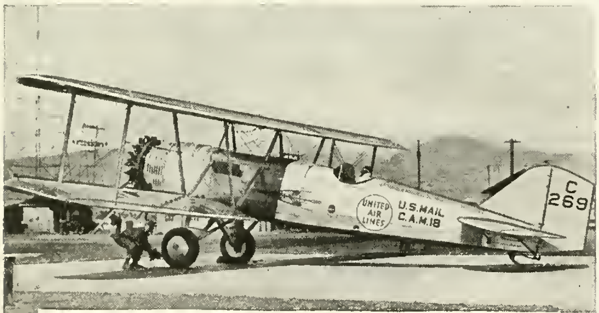

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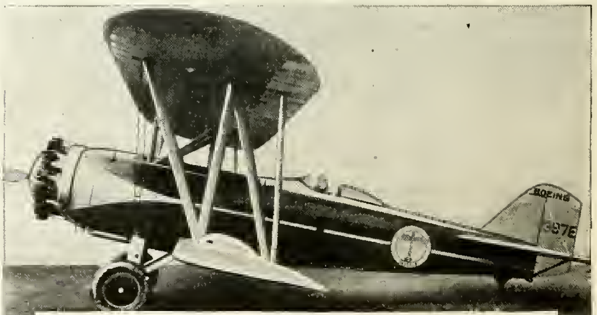

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WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To: Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Observation Airplanes, with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935; no communications received after 2:00 P.M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 788). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

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WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To: Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Single-Place Pursuit Airplanes, with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935; no communications received after 2:00 P.M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 788). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

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WACO F BARGAIN: Kinner B-5; never cracked, only 360 hours; steel propeller, ring. Snappy performance, $1,475. Trade American Rolls-Royce, 4-passenger sport coupe worth $5,000 for FC-2 or Waco, Stinson cabin. Boh Trader, Dravoshurg, Pennsylvania.

TRAVEL AIR SPORT: B-5 Kinner, condition absolutely perfect; no time since real major overhaul engine. Speed ring, starter, airwheels, etc. Dick Schall, Berwyn, Maryland.

KINNER BIRD: $1,150. Standard Trainer-125 B, $1,050. J6-5 Stinson, starter, $1,200. Warner Coupe, $1,650. J6-5 Aristocrat, $1,100. J-5 Stearman, $1,000. Commuter Amphibion, $1,850. Genet Barling, $850. American Moth, $675. Velie Monocoupe, identified license, $300. OX Travel Air, Waco, Command-Aire, $385 up. Millerized Eaglerock, $325. All planes subject prior sale. Wire for option. Terms arranged, pay balance as you fly. "Pioneer," c/o Airport, Syracuse, New York.

COMPLETE PITCAIRN Wright 300 Autogiro: Less engine, propeller, starter, instruments. Will sell whole or parts. Air starters, Continental, $85; J6-9, $100. Wood propeller hub, $25. J6-9 propeller, $95. Lycoming propeller, $100. Jerry Kelsey, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

ENGINES GUARANTEED major overhauled: P & W Hornet, A-1, $750; Wasp C-1, $1,100; Wasp "B," $750; Wright J6-9 E, $1,250; J6-9 D, $850; J6-7 D, $775; brand new Wright J-5, $1,000; new Wright Gipsy, $450; Lycoming R-680's, $685; Warner 125 h.p., No. 844, $475; Kinner K-5, $325; Challenger 185 h.p., $375; Comet E, $250. Bahh, 1100 Airway, Glendale, California.

MODEL 2 FRONT EXHAUST Kinner Fleet: Engine, airplane just major overhauled. $1,000 cash. No trades. Cracked-up Challenger Robin. Needs one wing, landing gear, stabilizer parts. $300. Indiana Air Service, Bendix Municipal Airport, South Bend, Indiana.

RECONDITIONED USED PLANE bargains: J-5 Cessna, J6-7 Stearman, Great Lakes, Wallace Touroplane, Curtiss Sedan, Waco 90, J-5 Travel Air, Taylor Chummy (brand new, less engine). Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

FOR SALE AT BARGAIN: J-6 330 h.p. B-5 6-place Ryan cabin ship. Equipped with Goodyear full Airwheels and brakes. Excellent set of instruments. Licensed till September 1935. Will accept lighter ship as part payment. Michigan Aero Motors, Jackson, Michigan.

MUST SELL FOR reasonable cash offer perfect Kinner Bird, licensed '36; airwheels, brakes, compass, airspeed, full NACA cowling, hand rubbed finish. C. L. Grau, Ottawa, Illinois.

AERONCA C-2: 400 hours, airwheels, engine majored, fuselage recovered; $325. Rover Driggs, also Hisso Eaglerock. Want four or five place J-5 cabin ship. Air Activities Airport, West Chicago, Illinois.

TRAVEL AIR 2000: Light type, special built. Licensed June. Fuselage just recovered. Ship refinished Fokker red and white. OX-5 top overhauled, ready to go, Hangar 2, Lunken Airport, Cincinnati. Reasonable. Aeronca C-2 now recovering, bargain. James S. Cox, Flemingshurg, Kentucky.

LYCOMING STINSON: Model SM8A; 1934 Lycoming Stinson; 1931 Great Lakes Trainer. All these ships are in excellent condition. Wire or write Neil McCray, Fairview, Pa., for description.

FOR SALE OR TRADE: Lockheed Vega, many extras, special paint, just relicensed; will consider small ship in trade or small auto. No reasonable cash offer refused. AERO DIGEST, Box 1990.

FOR SALE OR TRADE: Special Bellanca, model C-H. Built for long distance flying; ideal ship for freight or express; priced for quick sale. AERO DIGEST, Box 1991.

13 AIRPLANES, for sale or trade: Two J-6 Travel Airs; J-5 Travel Air; two OX Travel Airs; two J-5 Straight Wing Wacos; Warner Waco F; OX Waco; 6-place J-6 Stinson; Driggs Skylark, Rover-powered; Lamhert Cavalier coupe; Heath powered with Wright Morehouse. Will sell J-5 ships with or without motors. Trade in your ship or will accept cars of late model. Terms if desirable. Two almost new silk Irvin seat parachutes. Steel propellers for J-6 and J-5. Few brand new Hamilton wood props at $15. Flottorp, Marshall and Bennett carried in stock for all motors. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

J6-7 TRAVEL AIR: 3-place Sport. 22 hours since complete major overhaul; air wheels, tail wheel, brakes, starter; excellent condition. Will trade; price $1,600. Ernest O'Neill, 116-15 114th Avenue, Ozone Park, New York.

J-5 STEARMAN: Model CB3, in excellent condition. Total time on ship and motor, 575 hours. Equipped with bank and turn, rate of climb, compass, storage battery, starter, large landing light, front cockpit cover, and semi-air wheels with brakes. Price, $1,250. Will consider trade-in. Andy Stinis, Floyd Bennett Field, Brooklyn, N. Y.

J6-7 STINSON: A-1 condition, landing lights, flares; J6-7 Stearman: 190 hours total, many extras; Warner Davis: Just completely overhauled, motor majored. Box 734, Cohasset, Massachusetts.

WRIGHT J6-5 PARKS: Licensed till February 1936. Engine, 115 hours total time. Plane rebuilt and recovered last month. Equipped with brakes, bank-turn, pitch, compass, air speed. Price: $1,600; will trade. Also extra J6-5, two inertia starters, two Pyle landing lights, one Hamilton hub. Edward Taaffe, Winter Haven, Florida.

SACRIFICE: Challenger Travel Air 4000; licensed, never damaged; total hours, 345. Steel propeller, starter, ring, turn bank, rate climb, etc.; navigation, landing lights. Finish silver and maroon. Must be seen to appreciate. $1,050 or will sell less motor and prop, $850. Want Tank motor. Mankato Aero Service, Mankato, Minnesota.

KEYSTONE-LOENING COMMUTER: In A-1 condition; (40 hours since new). 'D" type J-6 300 with clutch, 17 hours since major. Full set Pioneer instruments, NC licensed. For further information or inspection: Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

NEW STANDARD D-33: Kinner B-5 3POLB. 320 hours total. Brakes, tailwheel, collector ring, steel prop. Factory overhaul on motor. Just relicensed. $1,175 cash. L. Macomher, 513 Seventh, Niagara Falls, New York.

PITCAIRN AUTOGIRO: 300 h.p. Wright engine, 3-passenger. Flown 800 hours. Any reasonable offer takes ship complete or will sell engine, rotor blades, other parts separately. AERO DIGEST, BOX 1970.

GOOD OX ROBIN: Airspeed, oleos, Miller rocker arms, licensed till November 1935; $500. OX Travel Air: Perfect condition, semi-airwheels and brakes, $500. Curtiss-Wright Jr.: $400. Kinner Fairchild 21: $975. 125 Warner Stinson Jr.: 4-place, $750. J-5 Pitcairn Mailwing: Blind flying equipment, $1,450. Will consider trades. English Cirrus parts; OX-5, OXX-6 parts. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

STINSON TRIMOTOR: Model T. Good condition; licensed for 10 passengers; Goodyear Airwheels and spare assembly, $2,875; consider trade. Curtiss Fledgling: Excellent condition, completely rebuilt, motor majored 1 year ago; finest training plane available, $850. Driggs Skylark: Inverted 75 h.p. Rover, excellent condition; ideal training plane; total time around 200 hours, $1,000. Waco '32 Cabin: 210 Continental with factory major, $2,500. OX Challenger: Miller overheads, Scintilla magneto; no time since major overhaul; recently recovered; $550. Warner Aristocrat: Good condition, duals; 10 hours since overhaul, $875, consider trade. Warner Stinson: Good condition, duals, $900. Lycoming engine: Good condition, heavy duty crankshaft; 200 hours since major, $385. Switlik chute: White silk, 24-foot seat pack; excellent condition. John T. Corrodi, Inc., Box 185, Bexley Station, Columhus, Ohio.

LAIRD J6-9: (Modernized to "D"), ring, pants, semi-airwheels and brakes, other extras. Cruises 140, top 170. Total 415 hours, 215 since major. License expires September. Finished silver, trimmed red and black. All struts and wires chromium. Beautiful job, fine condition. For immediate sale, offered at $1,650. No trades. Chicago. AERO DIGEST, Box 2009.

WE BUY, SELL AIRPLANES, equipment. Cash paid for used airplanes; quick action, all dealings confidential. Get in touch with us. Pioneer Aviation, Airport, Syracuse, New York.

NEW STANDARD D-29A: Kinner B-5 125 h.p. motor, 350 hours total, latest type cylinder heads, Heywood starter. Ship and motor in absolutely perfect condition throughout. Ideal training or private airplane. Location Cincinnati. Russell seat pack, Triangle seat pack, Triangle exhibition chute, reconditioned Aeronca propeller. AERO DIGEST, Box 1994.

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PLANES AND ENGINES FOR SALE

FOR SALE: Jacobs Beechcraft; J6-9 Speedwing; Waco C; Wasp Laird; Fairchild 22; Fairchild 24; Lambert Monocoupe; Warner Monocoupe; Stinson Jr.; Stinson Reliant; Lockheed Vega; Wasp Bellanca; Waco F-2; Aristocrat. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

DE LUXE GENERAL 102 E: 3PCLM; J6-5, just majored, modernized; ring, pants, wing struts, tail fairings, brakes, lights, storage battery, rate climb, bank turn, copper gloss finish. Bargain, $1,495. AERO DIGEST, Box 2011.

STINSON: Model R. Radio, many other extras. Waco cabin: 1933 model. Radio, 70 gallon gasoline tanks, many other extras. Waco cabin: 1931 model. Standard equipment. All three jobs in good condition. Never cracked. All bargains, priced to sell. Wire or write The H. C. Robbins Co., Cleveland Airport, Cleveland, Ohio.

LYCOMING STINSON SM8A: Engine modernized, airwheels, speed ring, extra instruments, starter, leather upholstery, licensed. Must sell. Consider J-5 Bellanca trade. Dick Schall, Berwyn, Maryland.

WACO F WARNER: Ryan B-3; Waco 10; Kinner Simplex, less engine. Waco 10 parts and wings. New Ryan B-5 motor mount. Repairs and rebuilding. Charley Raudabaugh, 13210 French Road, Detroit, Michigan.

OX TRAVEL AIR: Recovered last spring; Miller overhead; licensed to September, $450. Nelson Flying Service, Wyckoff, New Jersey.

AIRPLANES FOR SALE: Kinner K-5 100 h.p. Lincoln PT two-place, engine overhauled and ship recovered, complete with radio, flares, and blind flying equipment, $1,245. Two Wright Gipsy Travel Airs, $1,225 and $1,275. J-5 Laird, $1,475. Stinson Reliant, $3,985. Two J-5 Stinsons, $1,150 and $1,650. Stinson Model S, $1,895. Model R Stinson, with radio, $2,985. Write for details. Chicago Aviation Corporation, Curtiss-Reynolds Airport, Glenview, Ill.

RYAN B-1: J-5. In good condition. Will take cracked job or ship needing repair in trade. Joe Grant, Middle River, Maryland.

FOR SALE: Cracked Waco F top wings, fuselage, tail assembly, wheels, tail wheel okay; 125 Kinner good, less two heads; steel prop bent. $300 cash. J. C. Cox, Charlotte, North Carolina.

OXX-6 ROBIN: New Millerized motor and prop, semi-air wheels with brake assembly; excellent shape; will trade for late model car. Emil Young, Forest City, Missouri.

WANTED TO BUY OR TRADE

WANTED: Two- or three-place open or cabin plane; if cracked, state condition. Snaps if possible. State lowest cash price first letter. Joe Gregory, R.F.D., Ord, Nebraska.

WILL PAY CASH for Fairchild airplane, either model 71 or FC-2W2 in good condition; no crack-ups. Give complete details. Edgar Tobin Aerial Surveys, San Antonio, Texas.

WANTED AT ONCE for cash: J-5 Waco, Travel Air or Fleet or similar ship. Give full description and best price first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

HAVE CASH for Curtiss-Wright Jr.: Must be licensed, with new type Szekely engine. Describe fully. Other light planes considered. Aubrey Blackburne, Columbia, Tennessee.

HAVE SPOT CASH for three-place open ship, either radial or in-line motor. Must be cheap. Paul Calletto, 138 Willow Street, Newark, New York.

WANTED: Supercharger with gears for small engine. State details, price, etc. W. Behrend, care of Lago Oil Company, Aruba, Dutch West Indies.

WANTED: Licensed Warner Waco F. Must be in good shape, yet reasonably priced. H. R. Gustin, Pine City, New York.

WANTED: Used airplanes, closed or open jobs, in good condition. Write us, giving full description of ship. Erickson & Remmert, Inc., Floyd Bennett Field, Brooklyn, New York.

WANTED: LeBlond 60 engine and propeller, or trade Arrow Sport without engine for similar ship ready to fly. Will pay cash difference. Valley Airways, Inc., Winchester, Virginia.

WANTED TO BUY: One Campbell nibbling machine; one electric cowling hammer. Porterfield Aircraft Corp., 2500 McGee Trafficway, Kansas City, Missouri.

WANTED: Motor mount and oil tank for a J-5 C3B Stearman. Albert Grazioso, 647 Valley Road, Clifton, New Jersey.

WILL TRADE J-5 Travel Air open cockpit biplane for 2-, 3- or 4-place cabin plane in good condition. Address P. O. Box 897, Hartford, Connecticut.

WILL TRADE $5,000 beautiful ultra-modern streamline sound-equipped advertising car for modern licensed ship, with market value not less than $3,000. Cabin preferred. Car now under year contract, earning $200 week. DeLuxe Advertising Co., 796 Huntington Avenue, Boston, Mass.

WANTED: 5- or 6-place cabin job; consider ship needing recovering or repair. Give details and price in first letter. Tiffin Flying Service, Tiffin, Ohio.

WILL PAY CASH for airplanes, engines or parts in any condition. Write complete details, prices, etc., in first letter. J. E. Poission, 1219 Penn St., Grand Rapids, Michigan.

WANTED TO BUY: Travel Air biplane, 2-, 3- or 4,000. 3,000 preferred. Must be cheap. Henry Clergy, 524 Eleventh St., Des Moines, Iowa.

WANTED: Upper and lower left wings for American Eagle 201. H. E. Beneke, Liverpool, New York.

WANTED: Waco F-2; Continental or Warner job. Send full details first letter. Charles Babb, 1100 Airway, Glendale, California.

WANTED AT ONCE for cash: Good J-5 motor, propeller and starter. Give full description, hours and best price first letter. Michigan Aero Motors, Jackson, Michigan.

HAVE BEAUTIFUL 3¼ carat Diamond Ring, value $1,200 and some cash for good licensed, air-cooled ship. What have you? AERO DIGEST, Box 2010.

WANTED: OX Bird Travel Air or Robin. Must be licensed and very cheap for cash. Send photo if convenient. Ray A. Bramer, Aredale, Iowa.

WILL EXCHANGE Arrow Sport for 100 h.p. Kinner Fleet and pay a cash difference. Frog's Flying Field, Inc., E. Moriches, New York.

WANT SZEKELY, Aeromarine, Jacobs or similar engine complete with prop and hub. Give full information with best cash price. Hambrick Electric Co., Fort Worth, Texas.

WANTED: Direct electric starter for a Wright J6-9; will pay cash immediately if priced right. 456 13th Ave., N.E., Apt. 6, St. Petersburg, Fla.

WILL TRADE: Velie Monocoupe, licensed, A-1 condition, just completely overhauled; airwheels, new propeller for later model Monocoupe or similar ship. Will pay cash difference. Wanted: Lambert 90 engine, also steel propeller. Must be reasonable for cash. 1222 Citizens Bank Bldg., Tampa, Florida.

WANTED: Parts for Sikorsky S-38-B. Wasp C. Prop or blades, Standard 5406 A. Electric starting motor; exhaust assembly, spark plugs, speed rings, beams or whole lower wings, blind flying instruments. Also camera, skis. Also other parts. Give lowest price. AERO DIGEST, Box 2000.

TRADE LATE 1934 Ford V-8 deluxe Tudor with radio, all A-1 shape, low mileage, prefer Taylor Cub or low-price plane. A. Bouchard, 420 W. 119th St., New York, N. Y.

WANTED: OX Bird, Travel Air or KR-21 Fairchild. Will buy ship needing repairs, $500 or less, for cash. Howard Morders, 4533 Wisconsin Ave., Washington, D. C.

AEROMARINE-KLEMM wanted: Preferably with LeBlond motor or similar light plane. State details, history and cash price wanted. George Kropp, Ravinia, Illinois.

OX ROBIN parts wanted: Left wing, skeleton preferred; rear main flying strut; wheel, side glass; and miscellaneous parts. Ernest Stultz, 222 Holborn St., Bristol, Tennessee.

WANTED: Great Lakes or two-place side-by-side closed job for instruction. All particulars first letter. Priced right. R. Foster, 623 W. 17th, Topeka, Kansas.

COMPLETE EQUIPMENT portrait commercial photographic studio. Includes two cameras, 5 lenses, moderne portrait camerastand with remote illumination control, tripods, lights, backgrounds, etc. Inventories $840; will trade all or part for any of following: Licensed airplane, licensed parachute, aerial camera, C-3 Aeronca floats, or cash. J. Slager, 434 Solon St., Toledo, Ohio.

MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

FINANCIAL BACKER wanted, who is interested in aviation development. I have postal registered plans for patents I am to apply for, on super speed airplane, automatic control of same and improvements on aircraft. To interested party I will give full details for financial proposition, or state your proposition. This offer is not open to any aircraft company or employee of same, and has never been offered to public prior to date. All letters will receive my personal attention. W. C. Neuffer, 173 Peckham St., Buffalo, New York.

PATENT OFFICE PRACTICE, my specialty; clients' satisfaction, my ambition. Registered patent attorney 28 years, No. 7780. Booklet and blanks, free. Sterling Buck, A-629 F Street, Washington, D. C.

LEARN TO FLY: Solo flight, $50; Limited Commercial, $250; Transport, $800. Decatur Flying Service, Inc., Decatur, Illinois.

FOR RENT: 106 acre licensed airport hangar, with brick floor office. Two miles from city of 18,000. Four ships on field now. A bargain if you act quickly. AERO DIGEST, Box 2006.

PERMANENT POSITION for young man interested in enrolling for Transport Flying Course. Must have mechanical ability, personality, be honest, capable and able to pay for course in advance. AERO DIGEST, Box 1993.

SALESMAN PILOT or young man having sales ability, wishing to enter aviation. We want ambitious, hard working man with references. Must have executive ability and able to invest $1,500, which will be fully secured. Write giving your age, past experience and references. AERO DIGEST, Box 1992.

FREE STORAGE: Do you need cash? Let me stop your expenses and sell your ship for you. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Penna.

SOUTH AMERICA: Pilot operating in South America will accept two young men for training as pilots. Applicants must have twelve to fifteen hundred dollars for preliminary training and expenses. Must be hard worker and nondrinker. Those accepted will receive several hundred hours co-pilot time on large equipment flying in one of the most interesting countries in Latin America. References exchanged. AERO DIGEST, Box 1997.

THE U. S. AERO UNITS will teach you how to fly at the lowest cost. No dues, membership or registration fee. Pay as you fly! We will place a new ship at your airport. Write for description of plan. Units are now operating and being formed all over the country. U. S. Aero Units, Inc., 122 E. 42 St., New York, N. Y

COME TO NEW JERSEY to fly. Near New York and the seashore. $50 to solo; transport course, $880. LC and Private, $250. Amateur, $175. New planes, best instruction. Write for booklet. Central Jersey Airport, Hightstown, N. J.

WE HAVE OPPORTUNITIES for flying students to earn while you learn, and also permanent position for graduates. Write for information immediately. Conrad Flying School, Winona, Minnesota.

FOR RENT: Airport, 32 miles east Pittsburgh, Pa., on Wm. Penn Highway. 65 acres, six runways. Large fireproof hangar, also road stand. Cox & Giffen, New Alexandria, Pennsylvania.

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MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

PROFITABLE FLYING SCHOOL: 40 students, Kinner Swallow Trainer; good income year round; $1,500. Selling on account of other business. Will accept plane suitable for private use or late car. 2456 E. 55th St., Los Angeles, Calif.

WANTED: European representation authentic aeronautical firms; anything from bolts to planes; living Europe, entree all aeronautical circles; interview can be arranged. References exchanged. AERO DIGEST, Box 2002.

WANTED TRANSPORT PILOT: E & A mechanic; with 4-6 place cabin ship and some capital; young, ambitious, honest, who wants to better his social and financial position in the future, as third partner in business now organizing. Good opportunity for right man. AERO DIGEST, Box 2001.

AERONCA DISTRIBUTOR offers time on new 1935 Aeronca airplanes, $3.50 hour solo; $5.50 hour dual. Thirty minutes from Grand Central by subway. Prices subject to change. Get aboard now. Authorized distributor Metropolitan New York, New Jersey, Westchester, Long Island. For full particulars, phone Edwards Flying Service, Flushing Airport, Flushing, N. Y. INdependence 3-4843.

PARACHUTES FOR SALE

PARACHUTES: Approved types bought, sold, exchanged, repaired, packed, rented. Specify fully requirements. Airports should investigate drawing power of balloon and inexpensive operation for Sunday business. Thompson Bros. Balloon & Parachute Co., Aurora, Ill. Established 1903.

IRVING PARACHUTES: 24-foot silk seat pack, good condition, $75 for quick sale; going fast. John Bolling, 65 Monroe Street, Berea, Ohio.

IRVING 24-foot white silk seat pack, never jumped; Number 14572. Made 1930. Bargain at $95. William Picune, 743 Thirty-Fourth St., North Bergen, New Jersey.

RUSSELL CHEST PACK: Approved type, packed by licensed packer. Used very little, fine condition. Complete with harness and carrying case. $85. Foster Oil Co., Draper, South Dakota.

HELP WANTED

WANTED: Unemployed transport pilots. We will start you in your own business; furnish a new plane and salary. No capital needed. AERO DIGEST, Box 2012.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

LYCOMING MOTOR R-680: No time since top overhaul; 84 hours since major; total time, 520 hours. New forged pistons, new heavy type rocker arms, magneto, carburetor, electric starter, exhaust ring. Perfect condition, ready to install, $675. Propeller recently etched United Air Lines, $175. Cowl ring, $35. SM8A motor mount, $35. Empennage, $60. Tail wheel assembly, $15. Lou Foote Aircraft Company, Hangar A, Love Field, Dallas, Texas.

IRVING 24-foot seat pack chute, guaranteed good condition, $50. Monocoupe wing struts, new, $30. OX Waco 90, flyaway, $250. Mayer Airport, Box 252, Bridgeville, Pennsylvania.

LIMITED STOCK of new shock cord: ⅜-inch—.03 ft., ½-inch—.05 ft., ⅝-inch—.07½ ft., samples on request. Good used Cirrus heads; reconditioned J-5 blades; 22 x 10-4 Goodyear hubs; mud guards for 8.50 x 10 tires. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

LATE MODEL BUBBLE SEXTANT: Radio transmitter and receiver for long distance ship. AERO DIGEST, Box 1995.

FLIGHTEX Wing Covers: Waco, Travel Air, etc., $10. Fuselage covers, $12; others proportionately. Licensed cable splicing. OX-5 parts. Jet wrenches, 15c. Ostergaard Aircraft, Parr, Indiana.

SAVOIA-MARCHETTI hull and parts. Also instruments. Kinner K-5 motor, excellent condition, Heywood starter, 220 hours, $250. Vaughn McIntire, 1001 So. 23rd St., Fort Dodge, Iowa.

WING SALE: Large stock of rebuilt wings for all makes of airplanes; also struts and landing gear parts. N. L. Aircraft Co., Vermilion, Ohio, formerly New London Aircraft Co. of New London.

9.50 x 12 AIRWHEEL TIRES and tubes; Bellanca landing gear; complete exhaust collector and landing lights; also 11 x 12 tires and tubes; General Airplane Service, Roosevelt Field, Mineola, N. Y.

WRITE FOR NEW complete price list: Warner, Kinner K-5, Cirrus, Wright J-5 engine parts, instruments, and accessories. Ready-made covering, "Flightex, Grade A," for all airplanes. All parts guaranteed in good condition. Used parts purchased. Aviation Salvage Company, 6111 South Menard Ave., Chicago, Ill. Flat rate on expert instrument repairing with six months' guarantee.

WINGS, SPARS, ETC.: Large stock replacement wings ready to ship. Laminated, routed and plain spars. Shipped promptly on order. Also ribs. Send for list of our used parts. Chicago Aviation Corporation, Curtiss-Reynolds Airport, Glenview, Illinois.

POSITIONS WANTED

AERONAUTICAL ENGINEER: M.S., Pilot, 6 years aviation experience. Capable design, operation, management or sales. Now employed; married. Consider responsible position, foreign or domestic. AERO DIGEST, Box 1983.

TRANSPORT PILOT: 24, 1400 hours; cross country, barnstorming, instruction, radio, instrument, day and night. Careful, reliable, single, excellent references. Experienced secretary. Now employed but desire better position. AERO DIGEST, Box 1982.

TRANSPORT PILOT: 600 hours on all service types ships, Army trained; 29, married, desires any connection flying or managing airport anywhere. Best references. AERO DIGEST, Box 1985.

YOUNG MAN: 20, desires position in commercial aviation. 10 years model experience. Can use drafting instruments. 2 years college. Write to J. C. Kitchin, Scotland Neck, North Carolina.

TRANSPORT PILOT: Flying six years. Experienced on all types, including tri-motor equipment, radio beam and blind flying. Plus seven years of newspaper experience in news photography and office management. AERO DIGEST, Box 1986.

EXPERIENCED, LICENSED AE mechanic, pilot, welder, desires position anywhere. Graduate Department of Commerce approved school. Best references. Aged 22. Box 336, Ashley, N. Dak.

AERONAUTICAL ENGINEER: Continuously engaged in metal airplane construction for the past 12 years, experienced layout draftsman and stress analyst, best references, desires to change his present connection. AERO DIGEST, Box 1996.

TRANSPORT PILOT: 6 years experience in all types of flying; have over 1,000 hours; age 23, single, will go anywhere. Want position with future, either private or commercial. Employed now. Salary secondary. References. AERO DIGEST, Box 2003.

TRAFFIC MAN: 15 years experience, railroad and industrial, freight and passenger traffic. Now employed, desires aviation traffic position. AERO DIGEST, Box 2004.

TRANSPORT PILOT, aerial photographer, 21, single. Instruction, cross country experience. Have "K" movie and f4.5 Graflex. Go anywhere. Prefer flying position with future. Clean record. Ambitious. AERO DIGEST, Box 2007.

TRANSPORT PILOT: Six years experience all phases commercial flying. Excellent reputation. Clean record. Desires permanent connection with company or private owner. AERO DIGEST, Box 2008.

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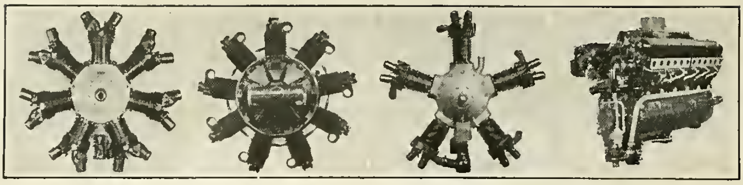

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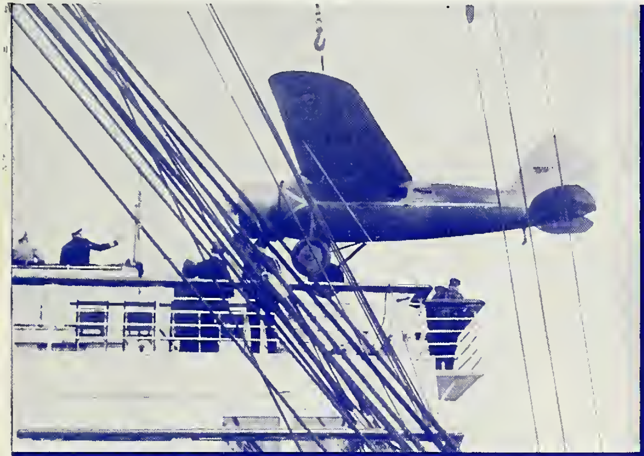
Amelia Earhart's Lockheed Vega being hauled aboard a liner at Los Angeles, bound for Honolulu.



The crowd roared—as Miss Earhart's ship landed at Oakland airport after completion of the first solo flight from the Hawaiian Islands to the American mainland. Her Pratt & Whitney Wasp engine was equipped with Thompson Valves.

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FRIDAY

10:10 p. m.: Amelia Earhart left Wheeler Field, Honolulu.

SATURDAY

1:28 a. m.: Miss Earhart radioed briefly: "all okay." It was estimated she was 400 miles from Honolulu.

5:47 a. m.: Miss Earhart reported visibility "fair."

8:20 a. m.: "Everything okay; flying 6000 feet, solid overcast."

9:48 a. m.: "Everything okay," Miss Earhart reported.

10:45 a. m.: Miss Earhart reported, "everything okay; flying at 7500 feet; weather clearing." Her voice showed no signs of fatigue.

11:17 a. m.: Miss Earhart reported "skies overcast, all okay."

11:47 a. m.: "Everything okay," Miss Earhart messaged, still not indicating her position.

12:48 p. m.: "Still flying over fog bank. Still okay."

2:46 p. m.: Radioed all is well, thanked station for giving her position.

4:30 p. m.: Miss Earhart landed at Oakland Airport.

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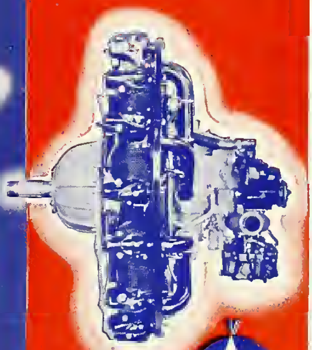

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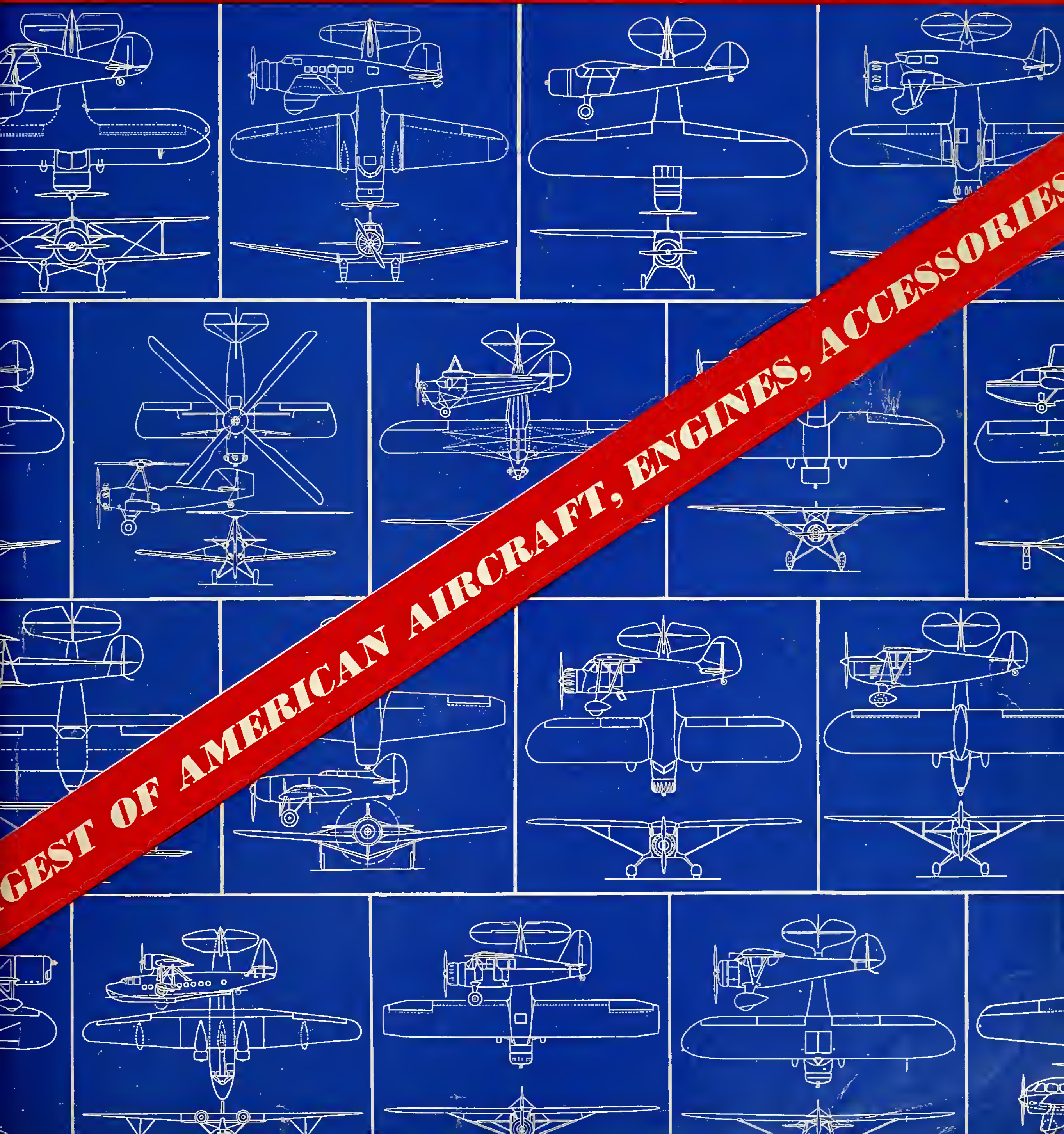
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Aero Digest, *April*, 1935
Volume 26. *Number* 4.

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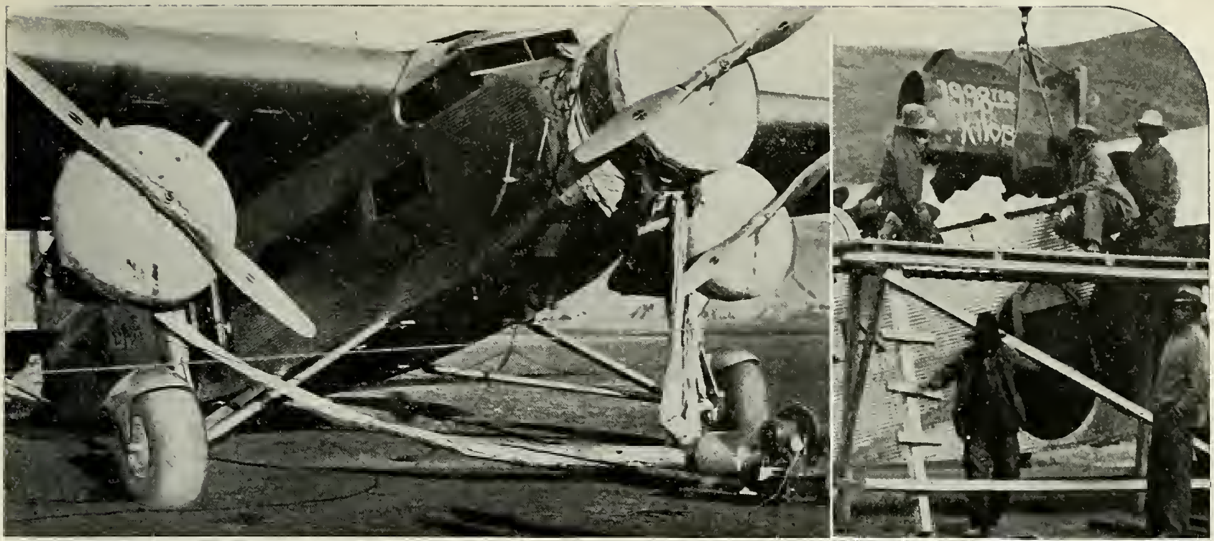

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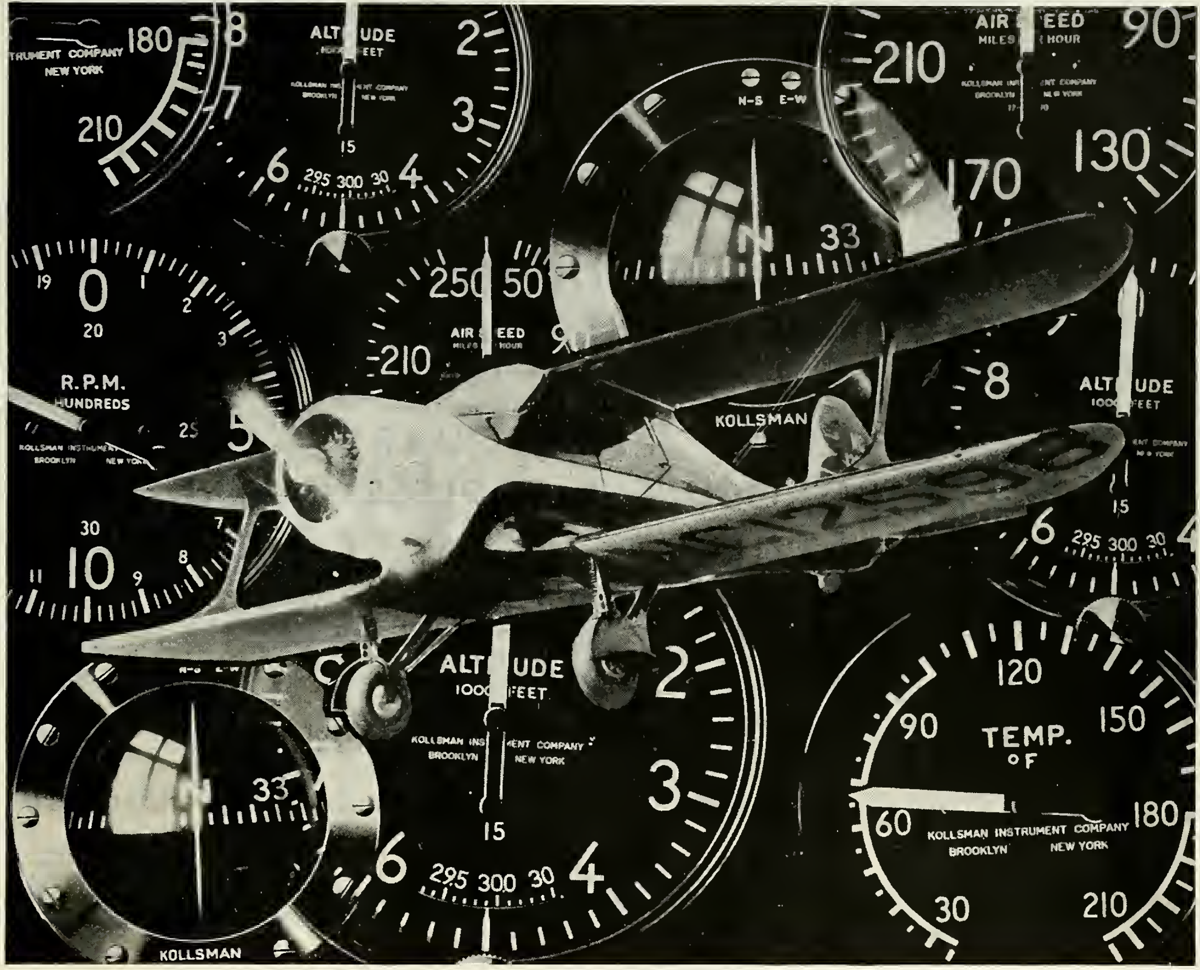

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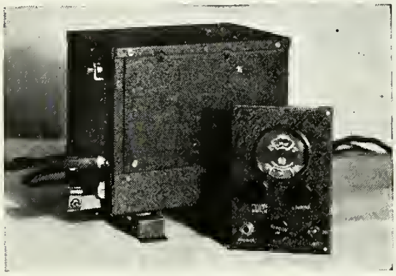

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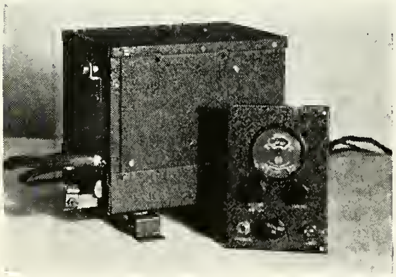

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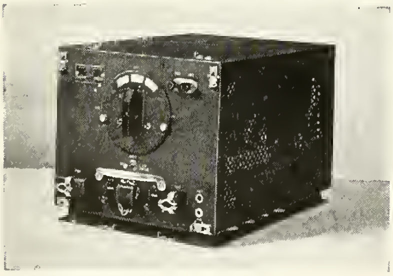

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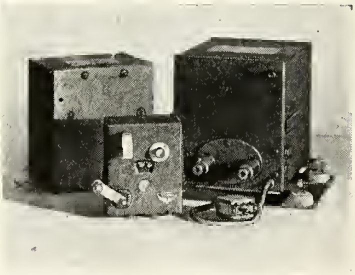

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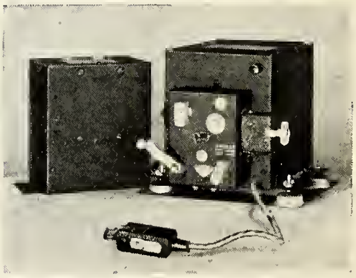

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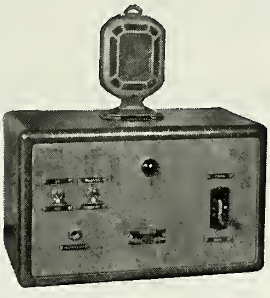

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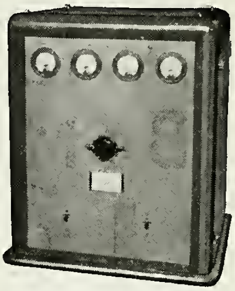

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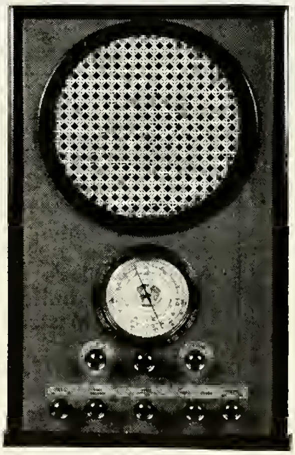

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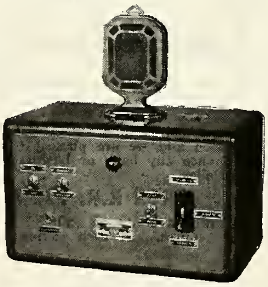
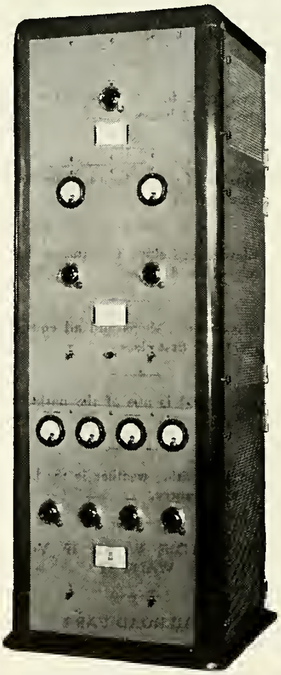


OPERATOR'S CONTROL BOX—For 125-watt radiotelephone-radiotelegraph-radiobeacon transmitter. Size: 12" wide, 8¼" high (less microphone), 7" deep.

Illustrating RCA Flexibility



125-watt radiotelephone — radiotelegraph-radiobeacon transmitter, illustrating the flexibility of RCA designs. Assembled with non-obsolescence of a customer's first purchase of Model AVT-1A. This RCA feature allows for the assured growth of your airport traffic control and instrument-landing requirements with a maximum of economy.

For further details, demonstration or purchase, address Aviation Radio Section

RCA MANUFACTURING CO. INC., CAMDEN, N. J.

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Love Field, Dallas, Texas

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Combined Radio Service and Repair and Aircraft Instruments ☐

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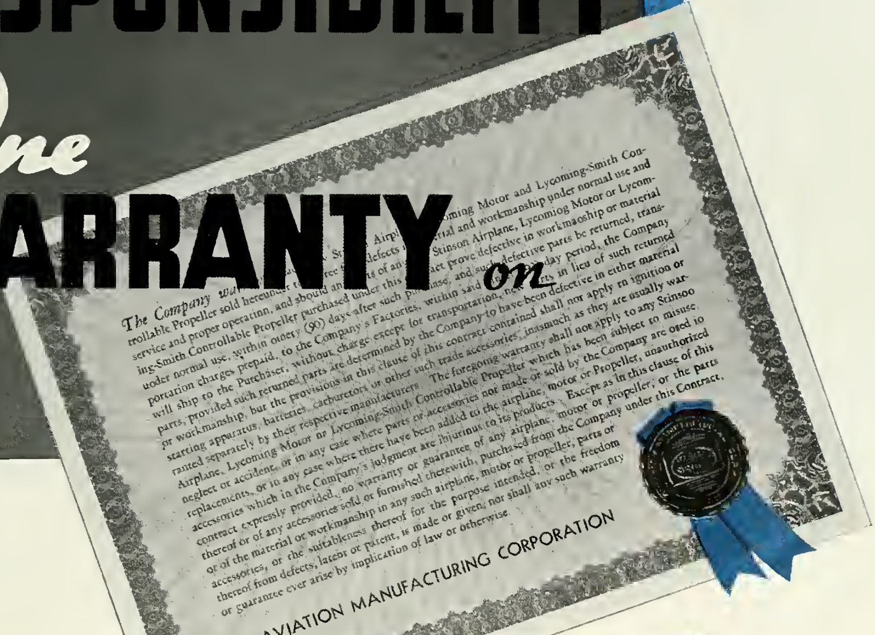
Address ....
City ....
State ....

One RESPONSIBILITY *One* WARRANTY *on*



The Company wa[illegible] St[illegible] Airpl[illegible]oming Motor and Lycoming-Smith Controllable Propeller sold hereunder to [illegible] free [illegible] defects i[illegible]rial and workmanship under normal use and service and proper operation, and should an[illegible]ts of an[illegible] Stinson Airplane, Lycoming Motor or Lycoming-Smith Controllable Propeller purchased under this [illegible]act prove defective in workmanship or material under normal use, within ninety (90) days after such pu[illegible]ase, and such defective parts be returned, transportation charges prepaid, to the Company's Factories, within said [illegible] day period, the Company will ship to the Purchaser, without charge except for transportation, new parts in lieu of such returned parts, provided such returned parts are determined by the Company to have been defective in either material or workmanship, but the provisions in this clause of this contract contained shall not apply to ignition or starting apparatus, batteries, carburetors or other such trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers. The foregoing warranty shall not apply to any Stinson Airplane, Lycoming Motor or Lycoming-Smith Controllable Propeller which has been subject to misuse, neglect or accident, or in any case where parts or accessories not made or sold by the Company are used in replacements, or in any case where there have been added to the airplane, motor or Propeller, unauthorized accessories which in the Company's judgment are injurious to its products. Except as in this clause of this contract expressly provided, no warranty or guarantee of any airplane, motor or propeller, or the parts thereof or of any accessories sold or furnished therewith, purchased from the Company under this Contract, or of the material or workmanship in any such airplane, motor or propeller, parts or accessories, or the suitableness thereof for the purpose intended, or the freedom thereof from defects, latent or patent, is made or given; nor shall any such warranty or guarantee ever arise by implication of law or otherwise.

AVIATION MANUFACTURING CORPORATION

STINSON AIRPLANES

LYCOMING MOTORS

LYCOMING-SMITH CONTROLLABLE PROPELLERS

WHEREVER transportation manufacturers have been able to produce the vital parts of their products within their own organizations, the public has benefited through better engineering, reduced costs and one responsibility for service.

In the airplane field this proven principle now holds good if you buy a Stinson Plane.

Stinson Planes, Lycoming Motors and Lycoming-Smith Propellers are made by one organization. Each product is engineered to best serve the other. There is one warranty and one responsibility for service. Inter-organization selling costs are eliminated and these savings are passed along to the buyer.

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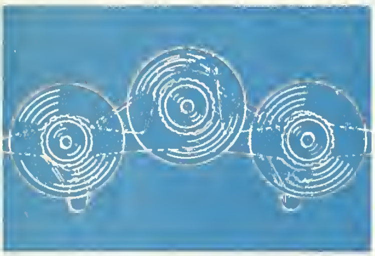
AVIATION MANUFACTURING CORPORATION

With increased fuel load and decreased passenger load,
this Airliner is ideal for long non-stop trips.

STINSON

Deliberately "cut" one outboard engine immediately after take-off. The fully loaded Stinson will climb to 8,000 feet. Three airline proven Lycoming motors further guarantee safety.

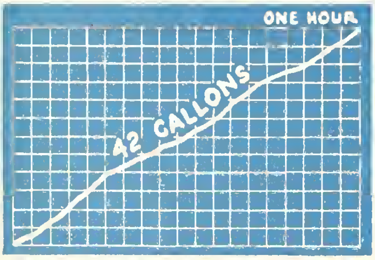
Tri-Motor Safety



"Quiet" planes improve passenger comfort. Propellers placed forward of passengers and pilot, absence of propeller overlap, and sound acoustical engineering are responsible for Stinson's "engineered silence."

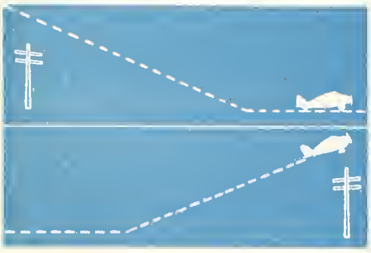
Engineered Silence

Controllable Propellers



Cruising above 160 MPH on 75% horsepower, Stinson uses only 42 gallons of gas per hour. This is only one of many operating economies.

True Economy

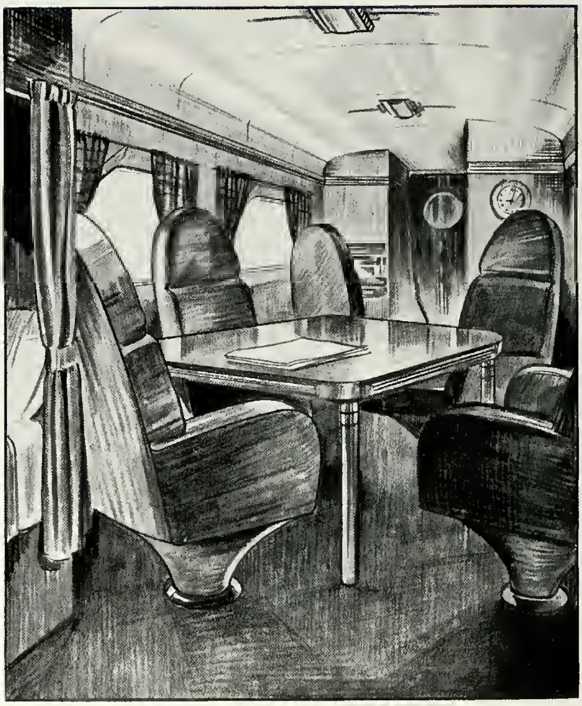


Airline pilots are enthusiastic about Stinson's quick take-off, short landing and fast taxiing ability which make safe landings possible in small, rough fields.

Short Landing

Quick Take-Off

Save Time



For the Executive

STINSON Trimotored Airliners are now being built for several nationally known Executives who have learned the business value of modern airplane travel through practical usage over a period of years.

Experienced in airplane ownership and operation, these men require high-speed transportation by day and night but they also insist on the maximum of safety, comfort and operating economy.

They selected the Stinson Executive Airliner because their experience convinced them that this plane best combined these vital features.

The Executive Airliner is available in a variety of interior treatments, one of which is illustrated above.

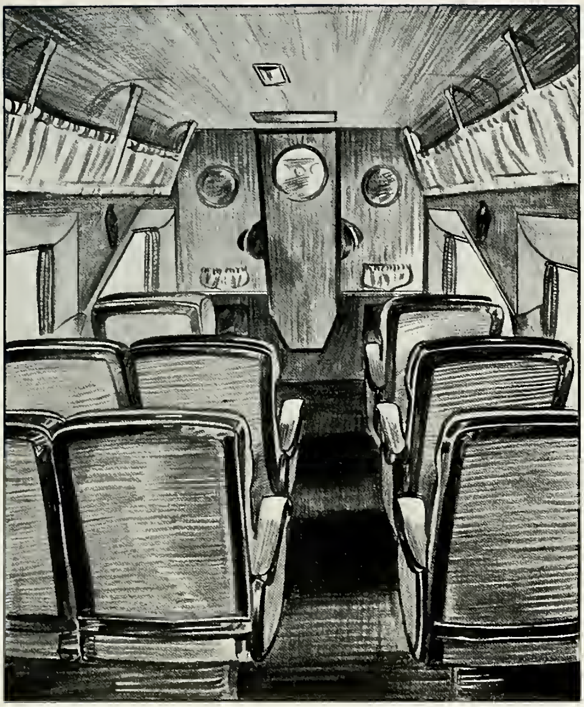
If your duties make swift travel necessary; if you wish the safety that three Airline proven Lycoming engines afford and if you wish *Fine Plane* comfort and prestige, heretofore unobtainable at reasonable cost, we invite you to write for specifications on the Stinson Executive Airliner.

STINSON AIRCRAFT CORP. • Wayne, Michigan, U. S. A.

Division of Aviation Manufacturing Corp.

AIRLINER

Built to airline specifications, this Airliner is master of the short high speed run at low altitudes.



For the Airline

CONVINCED as a result of service experience on American Airlines of the ability of the Stinson Model "A" Trimotored Airliner to consistently maintain fast schedules, to attract passengers and to greatly reduce flight costs, other Airlines have placed orders for these planes.

Operators who must make stops every 100, 200 or 250 miles, are realizing that the Stinson Airliner makes it possible for them to tap great potential revenue by giving modern, high-speed service to millions of people in scores of cities on the Transcontinental and North and South Airlines which are not now served by high-speed multimotored planes.

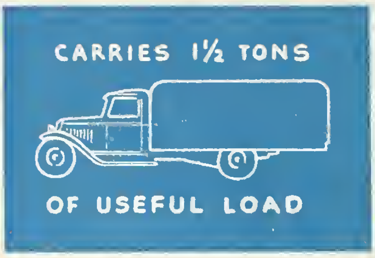
Because of its advantages the buying trend is definitely toward the Stinson Trimotored Airliner. Production is being stepped up as rapidly as possible. Yet in all sincerity we urge Operators now in need of new equipment to place their orders quickly so that we may cooperate in making the prompt deliveries which they require.

Rapid Climb

CLIMBS, FULLY LOADED, TO 5000 FT. IN 5 MINUTES

High altitude performance and ability to rise quickly above unfavorable weather is proven by the Stinson's rapid rate of climb when fully loaded.

Large Useful Load



Ability to cruise 1½ tons of useful load at more than 160 MPH at low altitudes with 780 HP stamps Stinson the most economical modern trimotor.

Handles Superbly in Good or Bad Weather

DESIGNED ESPECIALLY FOR NIGHT AND
BAD WEATHER FLYING

After many "blind flights" in airline service, pilots proclaim Stinson superior for bad weather because of excellent stability, which means ability to fly "straight."

Proven Steel Construction

LIKE A BRIDGE-
STINSON USES A PROVEN STEEL STRUCTURE

A steel structure, proven in 25 million miles of flight by 78 previous Stinson Trimotors, is responsible for Stinson's strength and low maintenance cost.

WORLD'S LARGEST BUILDERS OF CABIN PLANES

LYCOMING-SMITH CONTROLLABLE PROPELLER

Because this propeller has been proven in service by more Private Flyers and Flying Field Operators than any other controllable propeller, you may buy it, safe in the knowledge that it will improve airplane performance, make possible the carrying of greater payloads and that by reason of its tough chrome vanadium steel blades it offers better protection against nicks and abrasion on the ground, and pitting due to action of the elements.

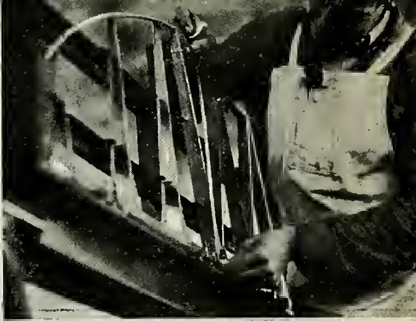
LYCOMING-SMITH
PROPELLER DIVISION
Williamsport, Pennsylvania, U.S.A.

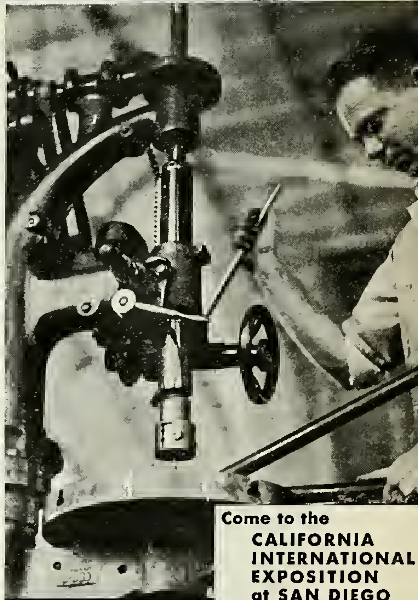
LYCOMING MOTORS

The motor is the heart of an airplane. In the interests of safety and economy it must be reliable. Since 1930 Lycoming has produced the most reliable motor in its power class because it has been proven in more than 80 million miles of flight by Private Flyers, Commercial and Airline Operators. You may buy the Lycoming at no increase in first cost as compared to other motors and with the assurance of greater reliability. It is true economy to insist on a motor which has flown at least 10 million miles in airline service.

LYCOMING ENGINE DIVISION
Williamsport, Pennsylvania, U.S.A.

AVIATION MANUFACTURING CORPORATION





3 Months Factory Work –
with pay – part of RYAN
Master Mechanics' Course

★Only at Ryan can you get this *complete* training. Here, under the ideal climatic conditions of sunny San Diego, Ryan *teaches*, then *trains* you for a better position. Manufacturers are enthusiastic about this feature—you serve your apprenticeship with pay at school and are ready for a full-fledged position on graduation.

Nowhere else can you get this important, extra help and nowhere else will your services be so much in demand after graduation as here in Southern California—the busiest, most productive aircraft center in the world.

Send for the new Ryan tuition schedule showing combination of courses approved by the Government which include flight training for transport, limited commercial, private and amateur licenses in conjunction with the complete 12 months Master Mechanics' instruction. Write for it today.

Photographs show Ryan Master Mechanics' students serving their apprenticeship in actual factory work as part of training for which they are paid. Below is shown part of the famous Ryan flight training equipment lined up in front of the School's Administration Building.

Come to the
CALIFORNIA
INTERNATIONAL
EXPOSITION
at SAN DIEGO
May 29 - Nov. 11, 1935

RYAN School of Aeronautics

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new Ryan S-R high performance plane . . . . ☐
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The Aeronautical Supply House of
PRICE · QUALITY · SERVICE

CHAMPION MICA SPARK PLUG

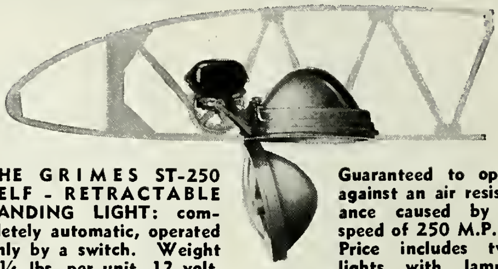
TYPE AERO M-3

ARMY-NAVY APPROVED:

The Champion Mica M3 spark plug now has the approval of the Army and Navy for aircraft engines, as well as the endorsement of several motor manufacturers. Absolutely gas tight. Comparatively inexpensive for a Mica plug.

CHAMPION AERO MICA SPARK PLUG ....**each $1.75**

GRIMES ST-250 SELF-RETRACTABLE LANDING LIGHT



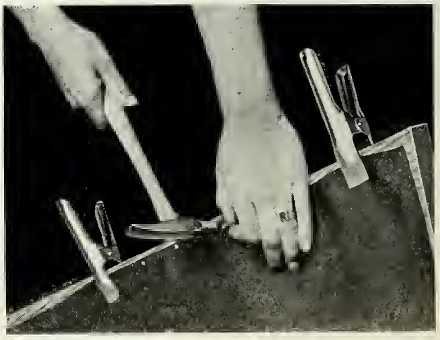
THE GRIMES ST-250 SELF - RETRACTABLE LANDING LIGHT: completely automatic, operated only by a switch. Weight 3¼ lbs. per unit, 12 volt, 315 C.P. prefocused lamps draw only 15 amperes. Guaranteed to open against an air resistance caused by a speed of 250 M.P.H. Price includes two lights with lamps, switches and switch plate.

GRIMES SELF-RETRACTABLE LANDING LIGHT ....**per pair $60.00**

HYDRO No. OX METAL PUNCH

Cuts holes up to 1/4" in 14 gauge steel. One lb. pressure on handle applies 48 lbs. pressure on the punch. Supplied complete with one each: 3/32", 1/8", 5/32", 3/16", 7/32", 1/4" and 17/64" die and punch assembled in sturdy tool case as illustrated. HYDRO No. OX METAL PUNCH SET, $5.90. EXTRA PUNCHES AND DIES (stock sizes), each, 25c.

K-V HANDY CLAMPS



K-V HANDY CLAMPS fill a real need. They grip immediately and hold fast. Very useful for covering, upholstering, welding, veneering, machine work, etc. Supplied in three sizes.

K-V HANDY CLAMPS—

No. 1 length 4", jaws open 1"	**each 34c**
No. 2 length 6", jaws open 2"	**each 42c**
No. 3 length 9", jaws open 3"	**each 84c**

SPECIAL ATTENTION GIVEN TO EXPORT INQUIRIES

The dependable export facilities of our company, which are the result of years of experience in handling orders for customers outside of the United States, places at the disposal of firms or individuals in every country of the World the latest developments in the progressive aircraft industry of this country. As the largest Aeronautical Supply House, complete stocks are maintained for prompt shipment of all supplies and accessories necessary for aircraft building and servicing; and as a supplier to governmental departments of the United States and many other countries the quality of our merchandise cannot be questioned. We invite your inquiries on anything in the aeronautical line.

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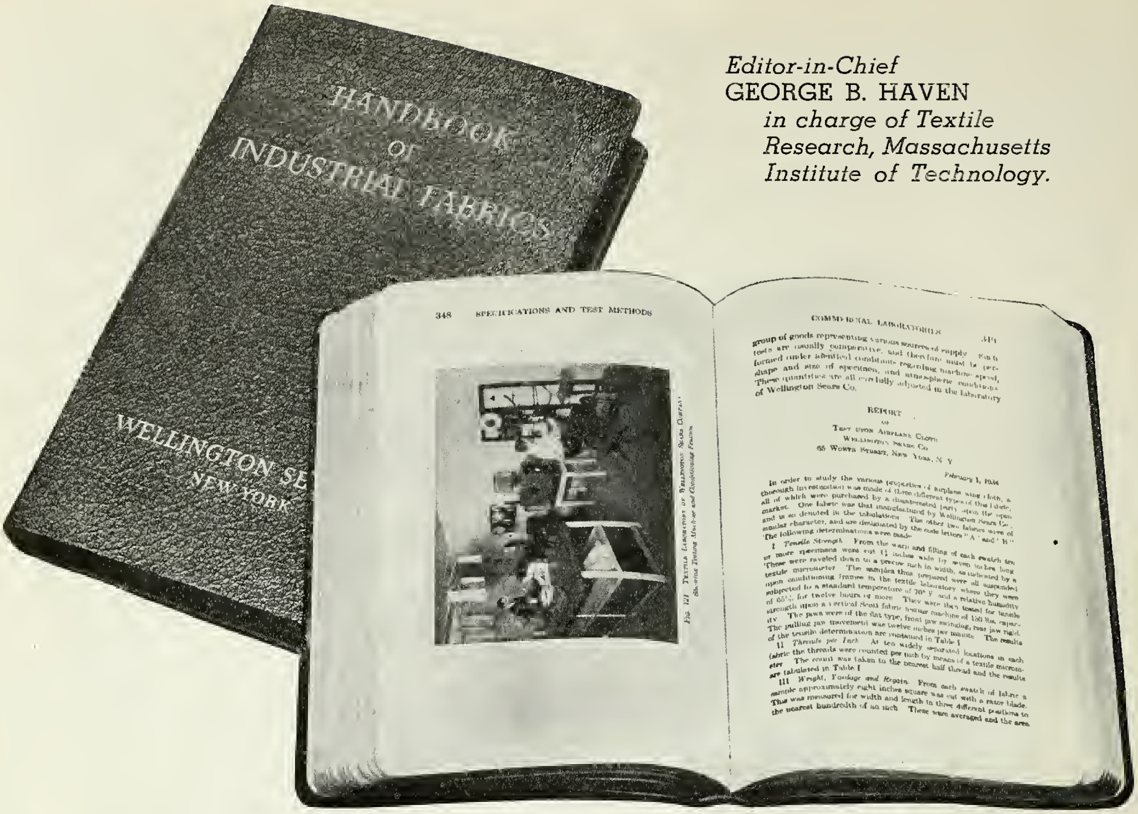

Editor-in-Chief
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in charge of Textile
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Institute of Technology.

New... Just off the Press... Handbook of Industrial Fabrics

Published by Wellington Sears Company

Contains Result of Test on Grade A—Aeronautical Fabrics

The new handbook includes on pages 349 to 354 the results of a comprehensive comparative test made upon the leading Grade A Aeronautical Fabrics.

One complimentary copy of the handbook will be sent free to any Aeronautical organization in the United States having satisfactory financial rating, upon request of one of their Executives, who writes on his business stationery and who indicates his position. Additional copies may be had at the price of $2.00 each.

Wellington Sears Company is the representative for seventeen large mills making 25,000 different cotton fabrics and is especially well known to the Aviation industry as the originator and distributor of BA-30 Fabric.

BA-30

Balloon and Aeroplane

was originally designed over two years ago as an improvement over the then existing fabric available. A self-imposed weight maximum of 4 ounces to the square yard has been adhered to since the beginning. Furthermore the elimination of any starch or sizing was accomplished. In BA-30 Fabric you get *all* cotton.

It, therefore, comes as no surprise to us that both the Army Air Corps and the Navy have approved in their tentative new Specifications for Grade A Fabrics a weight limitation of 4 ounces and a size content not to exceed 1 percent.

WELLINGTON SEARS COMPANY

65 WORTH STREET, NEW YORK CITY

BOSTON, PHILADELPHIA, ATLANTA, NEW ORLEANS, DETROIT, CHICAGO, ST. LOUIS, SAN FRANCISCO

AERO DIGEST

VOLUME TWENTY-SIX NUMBER FOUR

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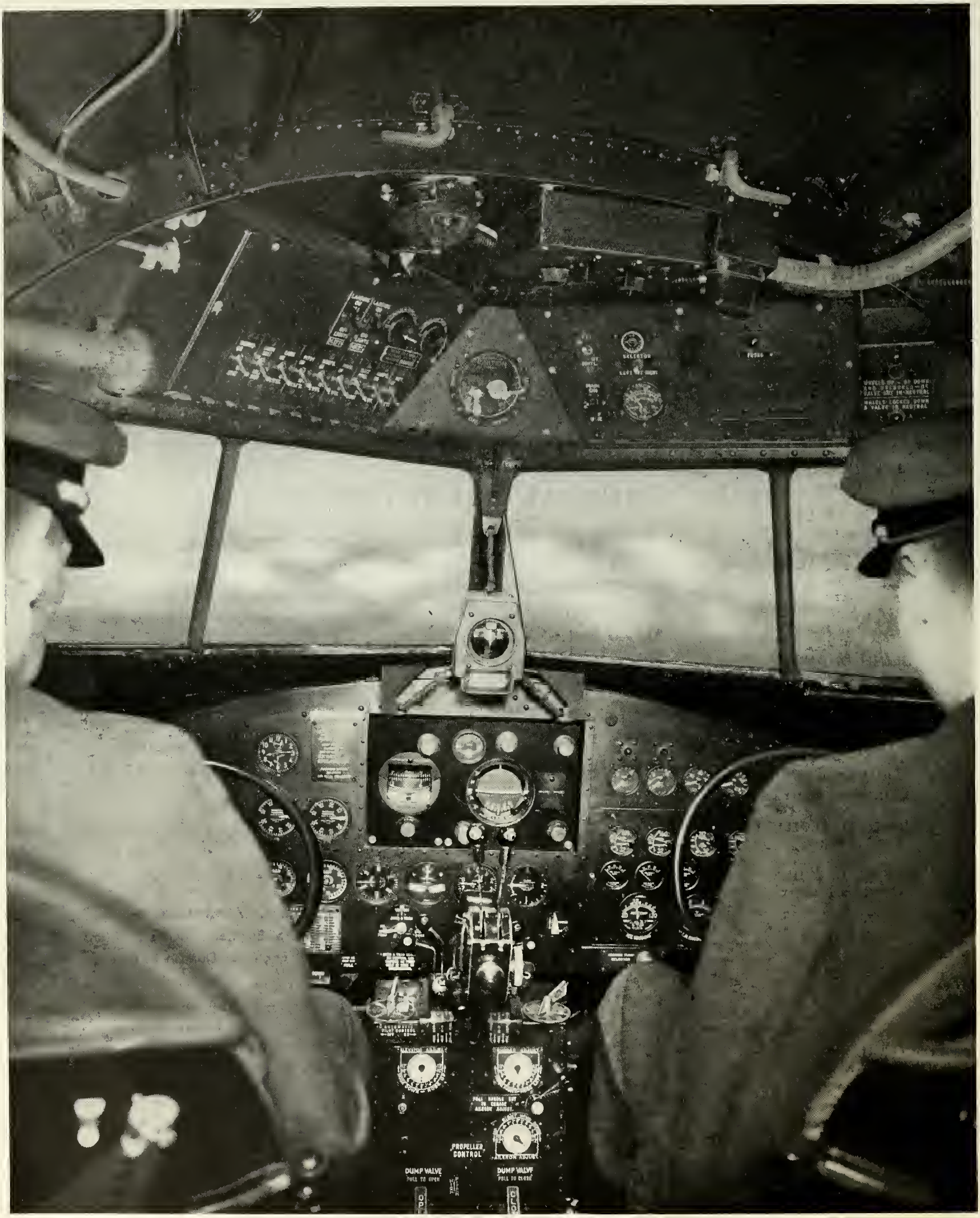


An array of modern instruments in the pilots' cockpit of a Douglas transport. In the center of the instrument panel is the Sperry gyropilot, standard equipment on all TWA Douglas transports. Above the windows are the electrical panel, remote control for the Western Electric radio, switches, landing gear position indicator, etc.

THE APPROVED TYPE CERTIFICATE

Proof of Airworthiness of American Commercial Airplanes

●

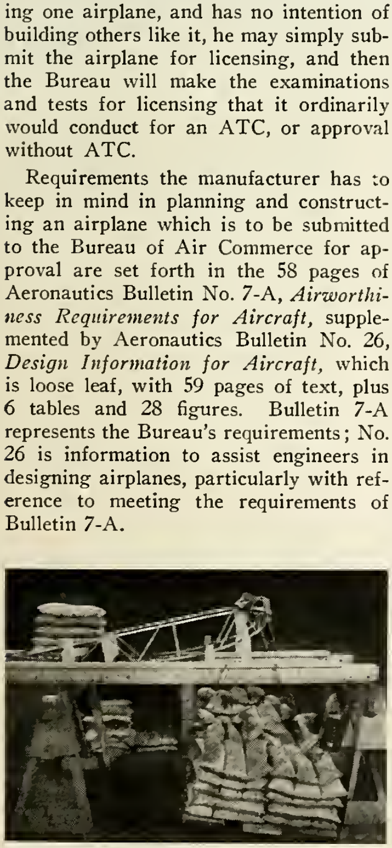
ALFRED V. VERVILLE

Chief, Manufacturing Inspection Service
Bureau of Air Commerce, Dept. of Commerce

● Before an airplane can be Federally licensed, the Bureau of Air Commerce, Department of Commerce, requires assurance that it is airworthy. In a majority of cases, the manufacturer satisfies this requirement by qualifying his product for an ATC, or approved type certificate.

There also are two other procedures under which the manufacturer can satisfy the airworthiness requirements. If he has a design which he proposes to manufacture in limited numbers, he may apply for an approval without approved type certificate (sometimes referred to as a Group 2 approval). Again, if he is building one airplane, and has no intention of building others like it, he may simply submit the airplane for licensing, and then the Bureau will make the examinations and tests for licensing that it ordinarily would conduct for an ATC, or approval without ATC.

Requirements the manufacturer has to keep in mind in planning and constructing an airplane which is to be submitted to the Bureau of Air Commerce for approval are set forth in the 58 pages of Aeronautics Bulletin No. 7-A, *Airworthiness Requirements for Aircraft,* supplemented by Aeronautics Bulletin No. 26, *Design Information for Aircraft,* which is loose leaf, with 59 pages of text, plus 6 tables and 28 figures. Bulletin 7-A represents the Bureau's requirements; No. 26 is information to assist engineers in designing airplanes, particularly with reference to meeting the requirements of Bulletin 7-A.



Static testing a Consolidated wing rib

By meeting the requirements, the manufacturer guarantees to pilots and passengers that the airplane is airworthy and safe. Bulletins 7-A and 26 represent a condensed resumé of everything that experiments and research have devised to make aircraft safe vehicles of transportation.

The body of data on this subject is tremendous. It might be said to have started with the work of the Wright Brothers at the beginning of the present century, although it could well be argued that the Wright Brothers built upon an extensive foundation laid by many capable inventors whose efforts to fly in powered airplanes were not successful. Since 1903, hundreds of men have contributed further to the science—many of them in the Federal government with the National Advisory Committee for Aeronautics, the Bureau of Standards, the Army, the Navy and the Bureau of Air Commerce. The fruit of their work is represented by the airworthiness requirements of the Bureau of Air Commerce, and the Bureau is zealous to keep the requirements and design standards abreast of new developments. For that reason Aeronautics Bulletin No. 26 is in loose leaf form, so that additions or changes can be made by mailing out new pages to be inserted in the book.

For studying new designs submitted by manufacturers, the Bureau's engineers must be a step ahead of the designers in knowledge of research trends. A new aircraft may have features which are not yet covered by printed regulations. The Bureau has to know how to reach decisions as to airworthiness of such innovations, and, as a matter of fact, its engineers frequently are in a position to advise manufacturers as to their proper application.

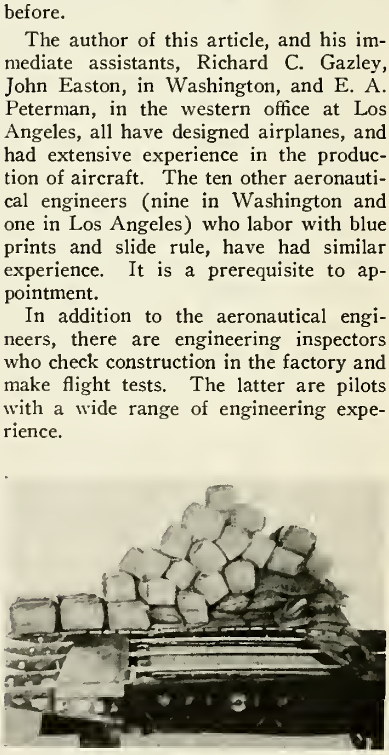
Approvals at this time more frequently apply to large multi-engine airplanes, requiring more time for checking than smaller types. These new craft, making their appearance on the scheduled airlines from time to time, also generally call for special studies covering new developments as mentioned previously.

In every project engineered by human beings, the human element is of extreme importance, and airplane designing is no exception. No more is there an exception for approving the designs submitted by others.

The airplane designer who packs up a set of blue prints and reports of tests to mail them to the Bureau of Air Commerce does so with the knowledge that these papers will be examined by men who are entirely familiar with his problems and are sympathetic with his efforts to solve them. Those who supervise this work have themselves devoted many hours at the drafting board and in the factory putting their ideas into metal, wood and fabric to bring into being airplanes that would do things which had not been done before.

The author of this article, and his immediate assistants, Richard C. Gazley, John Easton, in Washington, and E. A. Peterman, in the western office at Los Angeles, all have designed airplanes, and had extensive experience in the production of aircraft. The ten other aeronautical engineers (nine in Washington and one in Los Angeles) who labor with blue prints and slide rule, have had similar experience. It is a prerequisite to appointment.

In addition to the aeronautical engineers, there are engineering inspectors who check construction in the factory and make flight tests. The latter are pilots with a wide range of engineering experience.



Load test of a Luscombe wing panel

The volume of work handled by these men is constantly increasing, and the number of applications for approval indicates a healthy confidence in the immediate future of flying.

What is involved in the handling of these applications for approval may be best explained by tracing the course that is followed in a typical case.

The airplane design may be the product of one man's mind—more likely it represents the combined efforts of a manufacturer's design staff. In any event the ideas eventually are set forth on paper as structural drawings and notes. As the airplane takes shape on paper, the engineers are busy for weeks and months computing the stresses that will have to be withstood by this part and that. The weight of the airplane has to be borne in the air by the wings, and the stresses occasioned thereby are transmitted from one part to another in various ways. In addition, consideration has to be given to the stresses in various attitudes other than level flight, and in taking off and landing. When these computations have been completed, they comprise the stress analysis for the airplane, and this is submitted to the Bureau of Air Commerce.

Here the Bureau's engineers begin their work, checking the computations, and ascertaining whether the requirements of the Bureau have been met at every point. As they get along with this work, various changes may seem to be required. The Bureau will correspond with the manufacturer—the factory's chief engineer may come to Washington (or to Los Angeles if the application is being handled in the western office) for a conference on his plans, and this continues until the Bureau's engineers are satisfied that the design should result in an airworthy airplane.

In the meantime actual construction already has begun. At the beginning of this process some of the airplane's parts have to be structurally tested, by piling weights on the parts to see how much they will withstand. Some of the more important of these structural tests are witnessed by representatives of the Bureau; on others it is sufficient for the manufacturer to submit affidavits and photographs.

Finally the airplane will take on what appears to be its completed form. But there still are other checks to be made. First, there is an engineering inspection to determine that workmanship and materials are such as to produce an airworthy aircraft. Then the airplane is tested in flight. The proof of the pudding is in the eating—of the airplane, it is in the flying. The careful preliminary studies and the further checks made as the airplane takes shape, usually mean that the flight test is in fact the proof, and not simply an experiment to show the manufacturer where he should change or improve. The manufacturer's own flight tests, made for his own information, may bring out the necessity for certain adjustments and improvements. When it is time for the Bureau's flight test, if all preliminaries have been dealt with carefully, it should consist solely of the final proof of the airplane's airworthiness.

In addition to the foregoing, the manufacturer who wants an approved type certificate has to provide factory equipment that is suitable and adequate for the production of the airplane. If he has this equipment, and the airplane has met the tests outlined above, the Bureau will award an approved type certificate, and impress its seal upon the blue prints which represent the design.

Having won the ATC, the manufacturer goes into production, and each airplane manufactured under it will receive a license, provided inspection by the Bureau shows that it conforms exactly with the approved drawings. The ATC is valid as long as the manufacturer wishes to keep it in force, provided he maintains the factory facilities and otherwise conforms with Bureau requirements. Sometimes they are amended to permit changes, and when a design becomes obsolete and the manufacturer decides to discontinue it, the ATC is discontinued.

Procedure for Approval of Engines, Propellers, Components and Accessories

RICHARD C. GAZLEY

Chief, Engineering Section, Bureau of Air Commerce

● Every part of an airplane must contribute its part to airworthiness. At many points, the dependability of a particular part vitally affects the safety of the entire airplane, and that is why the Bureau of Air Commerce, Department of Commerce, gives detailed attention to the airworthiness of engines and propellers and to important components and accessories that go into the airplane.

There is another reason for separate approval of specific parts of airplanes. Engines, propellers, components and accessories are built separately, and assembled by the aircraft manufacturer when he produces an airplane. Some manufacturers fabricate more of their own parts than others, but if you think of an airplane for which the engine, propeller, wheels, shock absorbers, brakes, all engine and air navigation instruments, and many other components and accessories were purchased from other companies by the firm producing the airplane itself, it would be typical of practices in the industry.

The company manufacturing engines, propellers, components or accessories is assisted in the conduct of its business by these separate approvals, and the airplane manufacturer likewise is aided. Both of them know that if a specific part has been granted Departmental approval for use in the airplane of a type the aircraft manufacturer is designing, there will be no questions as to airworthiness of the particular part when the airplane finally is presented to the Department for approval.

Engine failure once used to be regarded almost as a necessary evil. Barnstormers of an era now fading into history were adept at getting their craft down onto the ground after their engines had ceased to function because they had plenty of practice.

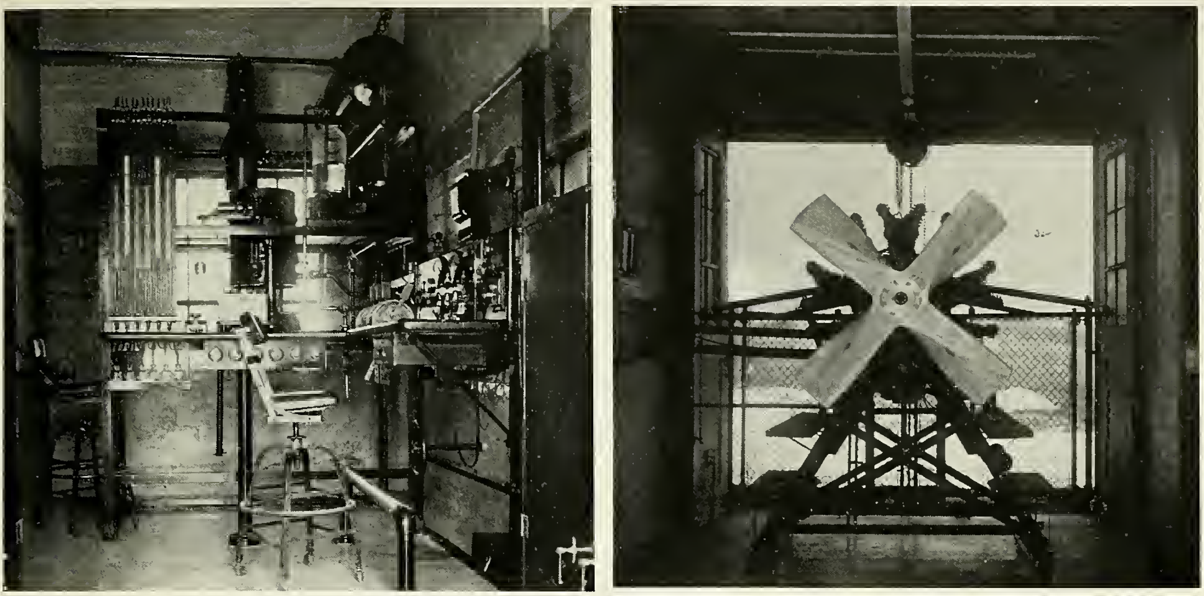
Present day engines are dependable—engine failures are infrequent, and may generally be charged, not to delicacy of the engine, but to carelessness in giving it the maintenance attention it deserves and should have. Departmental approval has played its part in this increased dependability, because the requirements insist that engines be constructed so as to take advantage of the advances made to increase efficiency and dependability.

Application for approval of an aircraft engine is accompanied by the following procedure:

> A report and log of a block test (with the engine set up on a stand on the ground). During this test run, the manufacturer has the engine in operation for at least 100 hours, including 50 hours with the throttle wide open.
>
> Data describing the status of the engine, explaining defects that have been discovered and corrected.
>
> Drawings, blue prints or photostats showing the design.
>
> Complete list of parts (in duplicate).
>
> Report of a 10-hour flight test, including a climb at full throttle either to 15,000 feet or to the service ceiling of the airplane.

If the foregoing is satisfactory, the Bureau then will authorize an official endurance test, on an engine stand, to be witnessed by a Bureau inspector. During this run, which is 50 hours at full throttle, in periods of at least 5 hours each on consecutive working days, checks are made of speed, power, temperature and other factors. The Bureau requires that the engine maintain a standard of performance throughout the test which would correspond with satisfactory and efficient operation in an airplane.

After completion of the 50-hour run,



Control room adjacent to Dept. of Commerce engine test stand, and engine on stand for endurance run

the engine is completely torn down and each individual part inspected. At this point, the Bureau's inspector may require revision in design to correct any faults revealed through excessive wear on certain parts, or, if excessive wear or failures are pronounced, the engine may be rejected.

If the engine passes these tests, it will receive an approved type certificate, testifying that it is eligible for use in any airplane designed for its speed, horsepower and general construction. Certain of the foregoing procedure is waived in the case of engines which have passed tests by the Army Air Corps or the Navy Department, provided copies of the test reports are submitted.

Many of the engines now submitted to the Bureau of Air Commerce for approval are designed for operation at high altitudes. Airlines, especially, want to operate their craft far above the earth in smooth air. Present indications are that much future flying will take place in the sub-stratosphere, and engine manufacturers are paving the way for operations of that type. This requires special calibration tests by the Bureau to determine performance of such engines at altitudes.

In connection with approval of propellers, as well, the Bureau has to keep abreast of rapid advances in designing. The aeronautics industry now has propellers of which the pitch, or angle of setting of the blades, can be controlled at the will of the pilot, giving maximum power at any speed. From that, the manufacturers are advancing to a propeller which makes this adjustment of pitch automatically.

The official test of a propeller for Departmental approval is similar to the test of an engine. The propeller is tested on the ground, mounted on an internal combustion engine, in a 50-hour run, either without a stop or in 5-hour periods. For controllable or automatic pitch propellers, the pitch changing mechanism is operated throughout the usable power range at least once each hour of the test.

A test of a fixed pitch wood propeller is somewhat different than the one just described. This type of propeller is subjected either to a 10-hour endurance block test or a 50-hour flight test.

As in the case of engines, Army or Navy endurance test reports will be accepted in lieu of the official Bureau of Air Commerce test.

Testing of parachutes for approval is a colorful operation, and one which is vital to the pilot who does flying requiring him to have a parachute. The Bureau first reviews the technical data and approves workmanship and materials, and then conducts drop tests. First the parachute is dropped 12 times from an airplane with a 170-pound dummy. Next it is packed with twisted lines, and dropped 5 times with the same dummy. There follow three drops with a 600-pound lead weight, from an altitude of not more than 500 feet, to test strength. These three series of tests are to prove the airworthiness of the parachute. The fourth, and final series does not take place if the parachute fails to open properly and promptly upon each of the drops.

This final test, consisting of two drops by a parachute jumper, is made to demonstrate that the harness is comfortable, and that the jumper can free himself of the parachute readily after reaching the ground.

Upon passing all of these tests, the parachute also receives an ATC.

There are other approved type certificates for landing-gear wheels, seaplane floats (excluding wing-tip floats), skis (including pedestals), position lights, and flares. Official letters of approval are written, provided the tests are passed, for such items as landing-gear shock-absorber units, special flight control units (including control wheels), engine-control units, autogiro rotor hubs, special structural units, and safety belts.

Certain other units are considered in connection with the individual airplane, and do not have separate approvals. In this category are such parts as wing ribs, fuel and oil tanks, auxiliary engine cowling and other special cowling, structure attaching seaplane floats to aircraft, wing-tip floats, structure attaching skis to aircraft, heating and ventilating systems.

For each component or accessory which is eligible either for approved type certificate or letter of approval, the Bureau has drawn up specific requirements. As in the case of other applications, the manufacturer submits drawings and conducts strength and performance tests prescribed by the Bureau. To qualify for an ATC, the manufacturer is required also to have manufacturing facilities adequate to produce the component or accessory in quantities and maintain the standard set up by the ATC.

The Department of Commerce began issuing ATC's for engines in 1927, for propellers in 1928, for parachutes in 1930, for components and accessories in 1933. To date, the total certificates issued in the various categories are as follows: engines, 139; parachutes, 53; propellers, 500; pontoons, 11; skis, 9; flares and signals, 6; and wheels, 26.

Pardon My Panegyrics!

•

CY CALDWELL

● In 1914 the World was admitted to the Psychopathic Ward of the Interplanetary Institute, and during the past several years has been under the clinical observation of the Gods whose duty it is to check up on the mental equilibrium of the various members of the Solar System. While their report will not be available to the human termites who inhabit this dizzily whirling globe, it is not unreasonable to suggest that Shakespeare wasn't far from the truth when he wrote, "It's a mad world, my masters." Research by Professor Gustavus Goupil, Ph.D., of Brauhaus University, Munich, leads him to the bald assertion that it is the planet itself which has gone insane; that the lunatic actions of the world's human and semi-human populations is merely an insignificant radiation of the essential insanity of the very earth itself; and that the interior of the globe is even crazier than the exterior — which hardly seems possible, everything considered.

The Wilder Things You've Heard

However, my purpose in mentioning our lunacies in this Special Number of Aero Digest is not to belittle our great country—for all of the other countries are just as crazy as this one, as Professor Goupil's research proves—but merely to point out that the wilder things that you people in other countries have heard about us are not descriptive of Americans as a whole, but of the more gaudy and voluble lunatic fringe which we insist upon electing to public office or of raising to positions of vocal importance in our national life. When you read, for instance, of the nightly cavortings of that trio of radio comics, Coughlin, Johnson, and Long, you are not to suppose that they truly represent us all, any more than Amos 'n Andy do. They are merely acting under the normal stimulus that motivates three Tomcats yowling on the back shed; they are working off their excess vitamin content, and having a whale of a good time doing it.

But under it all lies the sound, honest, conscientious industry of our plain people who, despite the handicaps imposed by our political pirates, manage to perform a great amount of useful work. Very little is said by or about these people, for they are mostly inarticulate. A howling hyena attracts more notice than the willing ox in the compound, as the old Hindu proverb says; and we've heard so much from our political hyenas that we tend to forget the honest creature who carries the burden—the ordinary work-a-day American, who goes about his task of running airlines and building airplanes and engines, and digging coal out of the ground, and raising wheat and baking bread, and all of the myriad activities which make up our national life. But he's been there all the time, poor fellow, unhonored and unsung, and practically unnoticed except at tax-gathering time.

Now Look at These Figures—

In aviation, for instance, the useful Bureau of Air Commerce of the Department of Commerce, informs us that on January 1 American-operated airlines had 6,455 persons in their employ. These included 503 pilots, 248 co-pilots, 2,201 mechanics and ground crew men, 1,846 other hangar and field employees, and 1,657 operations and office people. The lines had 518 airplanes in operation at the beginning of the year, not counting the one that David Behncke laid gently in a tree. These figures are for both domestic routes and extensions to foreign countries; and prove that under the Republican regime we really got somewhere with building up air transport, and that the New Steal Administration has not yet succeeded in wrecking it. Our airlines, domestic and foreign extensions, carried 561,370 passengers during 1934, while the tax-payers themselves carried 20,000,000 other citizens on Public Relief. So we've got a long way to go before we have as many air passengers as we have people riding on the backs of the tax-payers. In fact, if something isn't done to enable the airlines to survive the operation that Dr. Farley performed on them, the 6,455 persons now employed will have to cease functioning and climb aboard with the other 20 millions. The thing to do seems to be to plow under the airlines or Farley; we're suffering from overproduction of one of these items. If we killed off 6 million little pigs to stabilize the market, I don't see why we should hesitate about Farley, just because he's bigger. Quick, Franklin, the axe!

Now, my friends—as our First Actor amiably remarks to us common people when he's admonishing us over the radio —I want to say a few words about the American airplanes and engines you will find described in this issue of Aero Digest. None have been designed or built by Huey Long, Donald Richberg, Jim Farley, or Professor Tugwell. Not even the defunct Federal Aviation Commission, whose ghost has by now even ceased to rattle its chains, has had any part in the fabrication of these estimable products of the science of aviation, as it is pursued in these Delighted States. These machines, my friends, and their various accessories, have been built by the useful variety of American citizen, a being in no way related to the wild *fauna* whose doings you see chronicled in the newspapers. None carry guns, or make speeches. Though touched in some slight degree by the madness which Professor Goupil declares is rampant in the world today, I would not go so far as to assert that the members of our Aviation Industry are all clear thinkers, or they would be private bankers and J. P. Morgan would be out in the shops assembling engine mounts. But, take them all round, they're a pretty sound group; and they have done their level best to make the airplanes and engines you see here the very best of their kind in the world. You may purchase any of these products, my friends, safe in the conviction that the manufacturers have turned out an honest and estimable article, and are endeavoring to sell it for a fair price. I guarantee any of these machines to go up, my friends; though how they come down is up to you.

All Out of Encomium

Of course, as an American, I suppose I should write a panegyric or encomium on the merits of these ships, but I've just looked in the left-hand bottom drawer of my desk and find that I'm out of panegyric and encomium, and have got down to plain ordinary gin. And if there's one thing I can't do it is to grow lyrical on gin; I just get dopey on it, or peevish. Anyhow, why should you believe what I say about our airplanes when they have spoken for themselves in millions of miles of flying all over the civilized world and the District of Columbia; and no matter what a salesman or an editor may say—and both salesmen and editors are born liars, someone was telling me—airplanes and engines have a nasty habit of admitting the truth about themselves. So let the Product speak for itself and I think you'll find that our excellent American airplanes and engines will give as good an account of themselves in the work they are built to do as will any in the world.

Curtiss-Wright Ospreys flying over Central America during maneuvers recently held by the San Salvador Army Air Corps

Export of Our Aeronautical Products Increase

January, 1935, returns for export sales are more than double those for the same month last year, so that indications point to an even better increase in 1935 over 1934, although that year was by far the best yet experienced by American aeronautical manufacturers

● Throughout the world American aircraft and engines are flying thousands of miles daily for widely diversified purposes. From Europe to the Orient passengers, mail and express are transported with regularity. In South America they are flying over jungles and into mountainous country carrying engineering equipment and mining machinery, and transporting personnel and material between bases of operation. In Canada, prospectors are flown hundreds and thousands of miles into the wilds where they are left to seek their objective, but to be picked up at a later date and returned to civilization.

The United States has reciprocal agreements with Belgium, Canada, Germany, Italy, Norway, Sweden, Great Britain, and the Union of South Africa which include provisions seeking to insure the airworthiness of aircraft exported or imported. To expedite exporting to these countries and to others as well, the Bureau of Air Commerce, Department of Commerce, issues certificates of airworthiness for export. The certificate does not assure acceptance of the aircraft by a foreign country with which the United States does not have a reciprocal agreement, but it is a guarantee to the officials of another country that the products meet with the airworthiness requirements of the United States.

Exports of aeronautic products from the United States to purchasers in foreign countries have been made almost from the time that the first airplanes were built. Export business increased gradually to a peak of 269 aircraft exported in 1916, during the World War. After the entry of the United States into the war, aircraft exports fell off sharply, but following the armistice they began to increase again until in 1928 and 1929 this business doubled over each preceding year. There was a decline of exports of aircraft during the next two years followed by increased sales in 1932 and 1933; in the latter year 396 airplanes worth $5,389,739 were exported. Engine exports have increased in recent years, and there have been large increases in export sales of aircraft parts and accessories.

In 1934 China, Russia, Germany, Colombia, and Peru, in order, were the principal markets for aircraft. It naturally follows that these countries were the leading purchasers of aircraft engines, parts and accessories. In the past three years, Soviet Russia was the principal purchaser of aircraft engines, followed by The Netherlands, Germany, and Siam. Brazil, Japan, China, Argentina, Colombia, Peru, Germany, Soviet Russia, in that order, and 60 other countries purchased American parts and accessories.

Taking all aeronautical products as a whole the leading markets in 1934 were China, Soviet Russia, Germany, Colombia, Peru, Mexico, and Brazil, in order, followed by 81 other countries. The value of purchases ranged from a few dollars to many millions.

The total value for United States aeronautical exports for 1934 was $17,548,181 as against $9,155,882 for 1933 and $7,946,533 for 1932. The total for 1934 was almost double that for 1929, which was $9,202,380.

Year	Planes Number	Planes Value ($)	Engines Number	Engines Value ($)	Plane Parts ($)	Total Value ($)
1922	37	156,630	147	72,819	265,481	484,930
1923	48	309,051	80	65,558	58,949	433,949
1924	59	412,738	146	219,609	165,926	798,273
1925	80	511,282	73	170,793	101,584	783,659
1926	50	303,149	297	573,732	150,329	1,027,210
1927	63	848,568	84	484,875	570,117	1,903,583
1928	162	1,759,653	179	664,826	1,240,244	3,664,723
1929	354	5,574,480	321	1,375,697	2,252,203	9,202,380
1930	321	4,819,669	377	1,635,076	2,351,651	8,806,396
1931	140	1,812,827	318	1,474,785	1,521,828	4,809,440
1932	280	4,358,967	2,356	1,517,682	1,756,421	7,946,533[1]
1933	396	5,389,739	2,901	1,430,787	2,247,834	9,155,882[2]
1934	490	8,258,484	1,007	4,383,787	2,247,834	17,548,181[3]

[1] Includes $313,463 for parachutes; [2] $87,522; [3] $98,466.

Table of exports from 1922 to 1934 indicating value of exported products

• EDITORIALS •

> "Direct take-off of the wingless autogiro will allow the use of fields with any kind of surface—ploughed, stone or marshy. When fully developed, it will permit autogiros to jump high enough to clear small houses, trees, etc. from a distance of only a few yards. Jumps up to heights of the order of 60 feet to 100 feet are theoretically possible without reaching prohibitive accelerations, but I believe that for practical purposes an initial height of some 20 feet is the maximum required."—Senor Juan de la Cierva.

Flight in the Stratosphere

● The dearth of actual development and experimental work on flight in the stratosphere is something to which more serious thought and concentrated action should be given. Too few attempts are being made at the present time to solve the intriguing problem of travel in the rarified atmosphere, yet there lies the most promising future of long-distance flight.

When before this year is out regular trans-oceanic service has been demonstrated to be feasible, then the acute need for greater speed will become apparent. Our large flying boats travelling at 200 miles an hour will take 15 hours to cross 3000 miles of water. Flying in the stratosphere, however, where the atmosphere is rarer and air resistance less, the distance could be negotiated in half the time, or less. Chances of trouble developing en route would decrease proportionately during the shorter run, and comfort would be enhanced by surmounting the meteorogical disturbances usually found below the troposphere.

Much has yet to be accomplished on supercharging engines for various high altitudes, heating the cabins and providing sea-level conditions to the pilots and their passengers. With such apparent advantages, it seems unreasonable that something more tangible than yet produced is still to be forthcoming.

The country making most progress with this problem will be in a position to gain dominance over the commercial air lanes throughout the world. Several years ago France and Germany projected aircraft for the stratosphere, but evidently their interest in such experiments suffered a relapse in favor of more immediate problems of military necessity. We, in the United States, have the engineers and the facilities, and it is to be hoped that more of our practical-minded engineers and pilots will delve into the problem with the same enthusiasm with which they brought commercial airlines to such a high state of perfection.

Wiley Post appears to be the "lone wolf" of the stratosphere clan who cares to take an airplane up to 35,000 or 40,000 feet and keep it there on an extended flight. He deserves commendation and praise for his pioneering efforts and his recent attempts to join the two coasts in seven hours by flying in the stratosphere.

Backed by the facilities of TWA and the financial support of Frank Phillips, well-known oil producer, Post's determined efforts may really be the initial wedge which will force nature to reveal her secrets of altitude flight. As Mr. Phillips picturesquely (and frequently) expresses it—"we are in the vestibule of a new era."

Continuing Progress Despite Obstacles

● American air transport operators placed themselves in an enviable position last year when they added a new safety record to their growing list of accomplishments.

With only one accident to every 654,610 miles flown, our passenger air services not only surpassed former performances, but achieved this goal in the face of the serious set-back they experienced during the air mail cancellation period. Rather than hindering dependability, as undoubtedly would have been the case in an industry not composed of such hardy pioneers, this now infamous ruling only delayed the normal orderly progress which was being made by the airlines. Although operations and schedules were for a time threatened with complete annihilation, they are now back to the steady upward progress from which they were detoured by an uncomprehending, if not malicious, political pet.

The spirit of these operators, whose feeling for the country, and for what their endeavors meant to it and to aviation, boldly stands out in pleasant contrast to the un-American and unethical practices of a petty politician who, by a whim of fate, suddenly found himself possessed of power without sufficient background to properly apply it.

The average speed of our airliners is considerably greater than that of European air transports. By engineering developments and characteristic perseverence, the industry has, Mr. Farley, achieved world leadership in every phase of air transportation—for which no thanks are due you.

Preparedness In the Air

● Optimists insist there will not soon be another war in Europe, yet there are others as firmly convinced that Mars is awakening from a Rip Van Winkle sleep.

In either case, however, there is no doubt, that aviation will play a dominating part in the military plans of all nations. This is borne out by the frenzied aeronautical activity abroad following Germany's sensational public announcement last month that she will seek parity in armaments with the major nations. This action does not come as a surprise to AERO DIGEST readers who read in the November, 1933, issue a statement by M. R. Nodolny, head of the German Delegation at the Disarmament Conference who said, "Germany's claim to simple justice and security is that either all States decide and undertake immediately within the necessary time limit to abolish their air forces, or Germany must claim the same right as the other States to maintain an air arm which will then also be essential for the defense of the country." It is perhaps indicative of modern war thought, that Germany's first move was to display an air force in an aerial parade over Berlin and in her talks with Sir John Simon demanded, among other things, an air force the equal of the French or the British.

With such an attitude confronting them, several of the leading European nations immediately took steps to increase their forces, the major attention being centered on aviation. England sought more aerial strength, asking for about $15,000,000 for this purpose; Italy announced a faster tempo for her military aviation program to renew and augment her air fleet in three years, half the time originally scheduled.

Rather than appearing as a harbinger of an impending struggle, this activity can be taken in the light of a preventive means, and an assurance toward maintaining the status quo of those nations inclined toward peace.

Considering the airplane primarily as a defensive, rather than an offensive weapon, there is no greater security for peace than an up-to-date and numerically-powerful air force.

AIR

Hot and Otherwise

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FRANK A. TICHENOR

● This spring of 1935 looms as one of special significance in the progress of American aviation. To the lay public it will probably appear the least impressive since 1927. Yet that seeming paradox is the very thing which renders it one of the most important. For the public is impressed by superficialities; it looks for heroes to worship. But aviation has grown out of the age of heroes. It has now definitely passed beyond the era of men and entered the era of machines.

The period of transition has been a long one, and the signs have sometimes been deceiving. Like the final shower just before the skies clear after a summer thunderstorm, we in aviation had our heaviest rain of heroes just as we were entering this new stage in our advancement. From the end of the war until 1926-27, our technical progress was about as fast as a snail. The Post Office was flying the air mail. That meant the same thing Government operation always means—no competition, little incentive to improve, stagnated progress. The Post Office Department's success in operating the mail lines was the success of the men who flew, not the success of the planes they had to fly. It was they who first began to conquer the problems of blind and night flying—not with the aid of, but in spite of, the crude instruments with which their old rebuilt DH's and Jennys were equipped. It was they who, after many fatalities and harrowing experiences, insisted upon more efficient ground organizations and at least primitive weather reporting facilities. It was they who demanded and got politicians eliminated from the ground organization of the air mail system, so far as it is possible ever to eliminate politicians from a Government-operated enterprise. It was indeed an era of men—of fine, courageous, high-spirited men.

And what may be said of the pilots who carried the mail may be said also of those who flew up and down and across the land barnstorming in old war-surplus planes. There were no prepared fields waiting for them—no beacons, no hangars, no expert services, no radio beams. Only cow pastures and haywire. Yes, theirs too was an era of men rather than machines.

Then in 1926-27 came private operation of air transport—and with it the transition. Competition immediately stimulated technical progress. New designs appeared, and improved planes were put on the market. At first these ships were mainly remoldings of the basic ideas of war-time aircraft. But, aided and abetted by the newly created Aeronautics Branch of the Department of Commerce, which made such splendid progress under Col. Clarence Young, engineers designed into them increased structural strength and reliability.

New money began to be invested in this promising industry. The expansion spread all along the line. The increased tempo of airlines was soon reflected in the field of miscellaneous commercial aviation services, and in the planes produced for such operations.

Then suddenly all this activity struck a high note of intensity—Lindbergh had flown the Atlantic! Many attribute these changes in aviation's progress to Lindbergh; it is more nearly true to say that Lindbergh was a phenomenon of these changes. To be sure, he emphasized, accelerated and augmented them. But they would have come anyway, because they were really the natural result of the injection of private commercial enterprise into American aviation. They were the product of the old-fashioned profit motive —that powerful incentive to progress which the present Administration tries to squelch as something vile and abhorrent.

But these changes represented only the transitional stage, the period in which civil aviation forsook war-surplus crates and moved forward to the firm ground of new planes incorporating structural soundness and slightly improved performance. Our present amazing strides in aircraft performance did not come until after the effects of the much-maligned Watres Air Mail Act began to be felt.

Despite all the balderdash of Fix-'em-up Farley about the collusion and corruption resulting from the Watres Act, it was that law which gave the airlines the inducement to build up efficient passenger and express services in addition to air mail. The introduction of an economic incentive to combine passenger, mail and express operations placed a new responsibility upon the airlines. To persuade the public to fly with them, they had to convince the public that air transport was safe. That could be done only by *making* it safe. But they had to do more than cultivate safety. They had to show the public that it was worth its while to use the airlines. That could be done only by stepping up aircraft speed to the point where it gave air travel an indisputable advantage over all other forms of transport. Finally they had to demonstrate that air travel was both reliable and comfortable; they had to be able to assure their passengers not only that they would arrive at their destinations as scheduled without the annoyance of forced landings and other delays, but also that they would arrive there without physical exhaustion, frazzled nerves and a case of temporary deafness to recover from before they could go about their business. Meanwhile, as they provided these accommodations for their passengers, they had to be able to carry a good size load of mail and express aboard the same airplane.

It was this set of requirements, plus the Watres Act's economic justification for meeting them, that led inevitably to a phase of technical achievement far surpassing anything any of us had dreamed of a few years ago. It gave us multi-engined ships which would *really* fly on one engine. It gave us flaps, controllable pitch props and tremendously increased loads per horsepower. It gave us cabins as quiet and comfortable as a Pullman. It almost doubled cruising speeds without anything like an equivalent increase in power. It greatly extended speed range. It lifted the automatic pilot out of a twenty-year-old laboratory and made it a practical day-in-day-out device. It improved weather reporting 100 per cent. In short, it made American transport aircraft and American transport operations the fastest, safest, most efficient in the entire world.

At the beginning of 1934 we were only on the threshold of this new era of technical progress. Now, over a year later, we are still only on the threshold. A stupid, myopic administration threw a bomb in the path of progress. Fortunately, the industry has continued to move ahead a little, though necessarily with a more halting step than if the Jobmaster General had not set off his foolhardy fireworks. It is a tribute to the airlines and the manufacturers that they have had the courage to advance even in the face of this confusion.

They know that the potentialities of this industry are limitless. We are only just out of the cradle of technical achievement. No one can even guess how much we can learn and how far we can go. But no matter how courageous we are, no matter how much faith we have in our destiny, we cannot get far if we submit to the Government's putting a halter over our heads. The Administration may protest that it wants American aviation to be the finest thoroughbred in the world. But even the finest thoroughbred cannot win races if its jockey keeps reining in on the curb bit.

DR. ALEXANDER KLEMIN
GLENN D. ANGLE
AVIATION ENGINEERING
DR. MICHAEL WATTER
DR. MAX MUNK

Possibility of Two-Control Operation of the Airplane

●

ALEXANDER KLEMIN
Daniel Guggenheim School of Aeronautics, New York University

● In the February 15 issue of the *Air Commerce Bulletin,* John H. Geisse, Chief of the Development Section of the Bureau of Air Commerce, is quoted as saying that negotiations are under way for the procurement of an airplane with new types of ailerons and slots with a view to eliminating the rudder control. Also, in the N.A.C.A. Technical Report No. 494, reports of successful flights with two-control operation are announced. The desirability of such simplified control for private flying is evident, and the topic is passing from the speculation stage to practical experiment.

The following questions must be answered in considering the possibility of the two-control system: (1) Is it possible to correct a pronounced lateral or directional disturbance (2) Is blind flying possible (3) Is it possible to initiate a turn (4) Is it possible to maintain a steady turn (5) How severe are the limitations to maneuverability (6) Is it possible to maintain control at the stall (7) Is it possible to recover from a spin or other abnormal maneuver and (8) Is it possible to land in cross winds?

The standard reference axes employed throughout the discussion are shown in figure 1, with a turn to the right, side slip to the right, roll to the right, etc., taken as positive. The axes are wind axes, so that the *OX* axis lies along the direction of motion in the plane of symmetry.

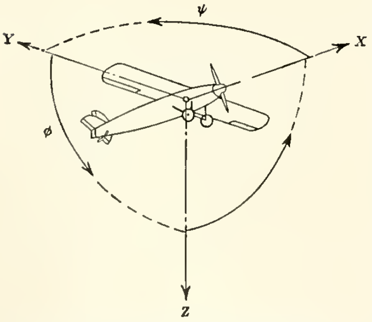


Figure 1. Positive standard reference wind axes, showing turn, side-slip, roll, etc.

In the discussion of flying at an angle less than the angle of maximum lift it is assumed that the airplane will have the customary characteristics of a stable airplane. Thus a side slip to the right or positive side slip will be followed by a negative rolling moment and a positive yawing moment; a positive yawing velocity (i.e. to the right), will be accompanied by a positive rolling couple because the left wing tip is moving faster than the right wing tip, and by a negative damping couple resisting the yaw to the right.

When the ailerons set to produce a positive roll, i.e. to the right, introduce a negative yawing couple, the yawing moment is said to be "adverse." If when set for a positive roll, they produce a positive yawing couple, the yawing moment is said to be "favorable."

Correction of Directional Disturbances

Ross Mahachek states in his *Airplane Pilot's Manual* "The inherent stability of a modern airplane will correct most bump deflections with less ultimate delay and rocking than would occur if the pilot tried to help." Nevertheless, the automatic pilot is coming to the front, and not all disturbances can be allowed to right themselves.

I—*Disturbance in Roll:* A roll to the right is accompanied by a side slip to the right, and then by a yaw to the right, with a complex oscillatory motion which damps out for a stable airplane. The quickest way to correct the disturbance is to use left aileron, and to keep the machine on its course with the rudder—using a little more rudder for the case of ailerons with adverse yawing moments. In skilled hands the corrective process can be very rapid.

If ailerons only are available, then adverse aileron yawing moment is detrimental, since the ailerons will increase the yaw while checking the roll.

If ailerons only are available, and the yawing moment is "favorable," then application of ailerons will check the roll and also stop the yaw to the right.

If rudder only is available, a large dihedral must be depended upon to introduce corrective rolling moments and check the side slip, while the rudder keeps the machine on a straight course against the yawing moments due to side slip introduced by the vertical fin.

II—*Disturbance in Side Slip:* If the initial disturbance is in side slip to the right or wind from the right (which the pilot is not apt to notice so quickly), it is apt to be accompanied by a roll to the left with yaw to the right, with a subsequent damping out of the motion with a stable airplane. Correction with right aileron and left rudder will evidently be very rapid.

If ailerons only are available with adverse yawing moments, then application of right aileron will be decidedly helpful since the yaw to the right will also be checked.

If ailerons only are available with favorable yawing moment, then application of ailerons may keep the machine on an even keel, but it may end up slightly off course.

Where rudder only is available, the yaw to the right could be checked by left rudder; correction would be rapid and the machine should quite easily be kept on the course.

(*Continued on following page*)

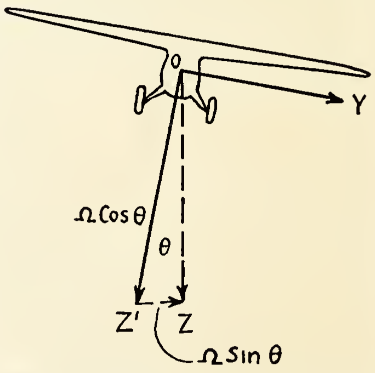
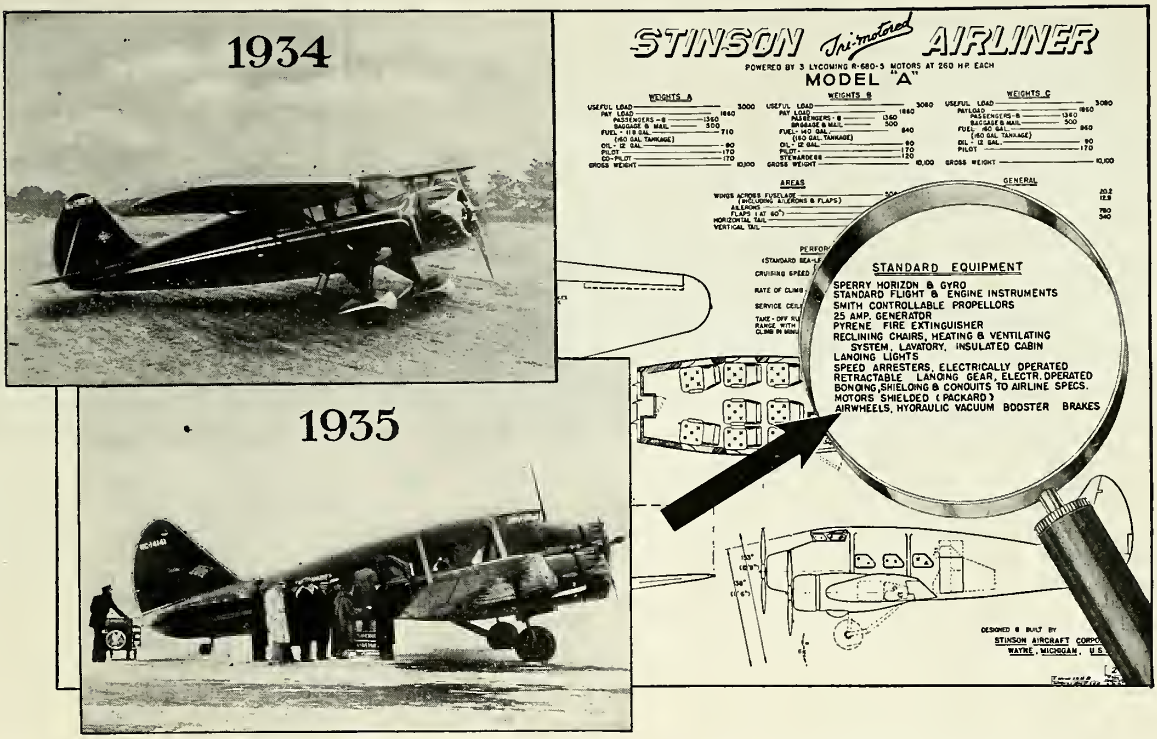


Figure 2. Angular velocities, forces and moments present in a steady turn



WEIGHTS A
USEFUL LOAD — 3000
PAY LOAD — 1860
PASSENGERS – 8 — 1360
BAGGAGE & MAIL — 500
FUEL – 118 GAL. — 710
(160 GAL TANKAGE)
OIL – 12 GAL. — 90
PILOT — 170
CO-PILOT — 170
GROSS WEIGHT — 10,100

WEIGHTS B
USEFUL LOAD — 3080
PAY LOAD — 1860
PASSENGERS – 8 — 1360
BAGGAGE & MAIL — 500
FUEL – 140 GAL. — 840
(160 GAL. TANKAGE)
OIL – 12 GAL. — 90
PILOT — 170
STEWARDESS — 120
GROSS WEIGHT — 10,100

WEIGHTS C
USEFUL LOAD — 3080
PAYLOAD — 1860
PASSENGERS – 8 — 1360
BAGGAGE & MAIL — 500
FUEL 160 GAL. — 960
(160 GAL. TANKAGE)
OIL – 12 GAL. — 90
PILOT — 170
GROSS WEIGHT — 10,100

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LANDING LIGHTS
SPEED ARRESTERS, ELECTRICALLY OPERATED
RETRACTABLE LANDING GEAR, ELECTR. OPERATED
BONDING, SHIELDING & CONDUITS TO AIRLINE SPECS.
MOTORS SHIELDED (PACKARD)
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HERE are three exhibits that tell their own story.

Above, at the left, is the Stinson single-engined Reliant model, made in 1934, equipped with Goodyear Airwheels and hydraulic brakes. This model is giving a good account of itself, literally all over the world.

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That's how these famous soft-landing, safe-landing tires and smooth-action, sure-action brakes have been winning their way on the leading transport planes and lines all over the country.

They make good wherever they're given the opportunity. Isn't it about time you wrote to the Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California, and found out what these tires can do for you?

* IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL! AIRWHEEL is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of AIRWHEEL Tires

WHEN YOU BUY A NEW SHIP SPECIFY THE GOODYEAR AIRWHEEL AND THE NEW GOODYEAR HYDRAULIC AIRWHEEL BRAKES

(*Continued from preceding page*)

Blind Flying

Howard C. Stark in his pamphlet *Blind or Instrument Flying* states that in ordinary flying, ailerons should be more frequently used than the rudder, but in blind flying recommends the 1-2-3 order. Turn is stopped by the rudder, then the ball is centered by ailerons, and climb indicator with elevators. It is difficult to see how this widely accepted practice could be followed with two-control operation.

Initiation of a Turn

I—*Ailerons with Adverse Yawing Moment and Elevator:* Let us suppose ailerons are used for a right turn. The bank to the right would be followed by a side slip to the right. The ailerons would thus immediately curve the path in space. If very large tail surfaces were available they would (due to the side slip) yaw the machine into the curved path and simultaneously drop the nose of the airplane since the yaw would take place about an inclined axis. The dropping of the nose would be resisted by the elevator (which has to be raised anyhow for the turn so as to increase the angle of incidence).

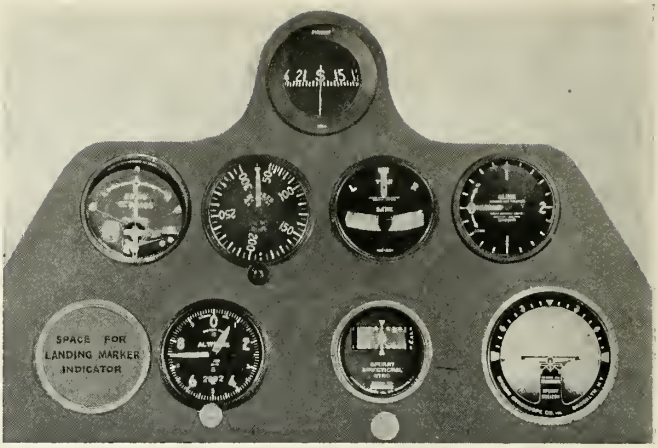
With sufficiently large vertical tail surfaces, the initiation of the turn would be readily possible though considerably slower than when rudder and ailerons are both used, and the elevator would have to be used somewhat more energetically.

II—*Ailerons with Favorable Yawing Moment and Elevator:* The initiation of a turn would be along the same lines as in I, but the initiation into the turn would be more rapid—or else smaller vertical tail surfaces could be used for the same rate of turn initiation.

III—*Rudder and Elevator:* If right rudder is given, the very first effect is that the aerodynamic force on the rudder skids the machine to the left. This militates against the turning couple of the rudder, and also has the disadvantage that the path in space is temporarily being curved in the opposite direction to that desired. It is only some time after that the rudder will succeed in yawing the machine sufficiently away from the original line of motion that a very large dihedral would have a chance of rolling the machine into the correct bank. It would seem, therefore, that initiation of a turn with rudder alone with very large dihedral is less promising than initiation of a turn with ailerons alone with favorable yawing moment.

Maintenance of a Steady Turn

Figure 2 illustrates the angular velocities, forces and moments present in a steady turn. At an angle of inclination Θ to the horizontal, and an angular velocity in space of amount Ω, we have an angular velocity $\Omega \sin \Theta$ about the transverse or pitching axis OY and $\Omega \cos \Theta$ about the normal axis OZ. Therefore, we have a damping moment in yaw tending to stop the turn, and a negative damping moment about the transverse axis. Again, owing to the angular velocity about the normal axis, a rolling moment tending to increase the bank is introduced. In a conventional machine performing a steady turn without skidding or side slipping we must therefore have (1) rudder set for the turn (2) ailerons set slightly against the turn (3) elevator stick pulled back a trifle less than for horizontal flight at the same angle of incidence.



Arrangement of flight instruments in Stark system of instrument flying

Provided the ailerons have an adverse yawing moment, a steady non-skidding turn can therefore be maintained by the use of the ailerons alone.

If ailerons with favorable yawing moments are employed, then with ailerons set to oppose the "natural" banking moment due to the wing tips, the favorable yawing moment will oppose the continuation of the turn. A certain amount of side slipping towards the center of the turn will be necessary.

If rudder alone is used then it will be necessary to have a certain skidding away from the center of the turn, so that the dihedral may overcome the natural banking moment.

Limitations to Maneuverability

I—*Where only Ailerons and Elevators are Employed:* In such a case we must have very large vertical tail surfaces. It is a fundamental principle in the lateral stability of the airplane that large vertical tail surfaces must be accompanied by correspondingly large dihedral, for lateral stability with controls neutral.

The rolling action of the ailerons is therefore limited by two reactions: (a) the damping in roll of the wings (b) the fact that a roll is followed by a side slip, and the side slip with very large dihedral is accompanied by a rolling moment opposing the action of the ailerons.

It appears evident at once that the speed with which a steady turn can be initiated by the ailerons will be less than that of a conventional machine.

In the steady turn the effect of the large dihedral will not be important, but to overcome the damping in yaw of the very large vertical surfaces, more side slip motion will be required than would be the case with a conventional machine turned only by the ailerons. With favorable yawing moment of the ailerons the side slip will be even more pronounced. There is evidently a decided limit to the angular velocity in turning which can be maintained.

II—*Where only Rudder and Elevators are Employed:* The initiation of the turn will be very slow. The rapidity of turn which can be maintained will be limited by the skidding out from the center which it is possible to use.

Control at the Stall

I—*Disturbance in Roll:* The now almost classical explanation of the incipient spin runs as follows: The airplane is at the stall, and experiences a disturbance in roll to the right, and hence a side slip to the right. The pilot applies left aileron, but the rolling power of the aileron at the stall is weak, while the adverse yawing moment is apt to be large. Therefore, the application of left aileron is likely to increase the yaw to the right due to the side slip. The natural rolling moment due to the yaw masks the rolling power of the ailerons. Hence, the airplane increases its roll and yaw, until an autorotative condition is reached. Coupled with the autorotation the wings produce a positive yawing couple. Coupled with the longitudinal diving motion so apt to occur at stalling, the stage is set for the incipient spin.

Evidently at the stall a powerful rudder is essential to keep the machine on a straight course and allow the ailerons to function in restoring the machine to an even keel.

If the ailerons have a "favorable" yawing moment the situation is much better, since they will act against the yaw as well as against the roll.

(*Continued on following page*)

THE BEECHCRAFT

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WICHITA, KANSAS

(*Concluded from preceding page*)

But, this does not mean that control with ailerons alone can be maintained at the stall, even if their yawing moment is favorable. We can imagine a really bad stall following on a steep climb and a roll and side slip to the right. The very large vertical tail surfaces would swing the machine to the right. If the wing were at the autorotative stage (with the positive yawing couple generally accompanying this condition), the ailerons (weakened in power at the stall), might not check the roll sufficiently quick, and the turn to the right might persist thus masking the power of the ailerons. Without rudder there would always be uncertainty as to control at the stall, and the greater the departure from an even attitude the greater would be the danger of the incipient spin.

II—*Disturbance in Side Slip:* If the initial disturbance is a side slip to the right, there will be a yaw to the right, with subsequently a roll to the left. Application of right aileron with "favorable" yawing moment will actually be detrimental since the yaw to the right will be increased. Here also the rudder remains essential.

Recovery from the Spin

It may be briefly stated that a spin may occur with or without the use of the ailerons; that in the recovery from the spin, ailerons of all the types employed hitherto are equally helpless; that large unblanketed tail surfaces are most important, and that the rudder is by far the most effective weapon for speedy recovery from the spin.

Landing in a Cross-Wind

A distinction should be made between drift landings and cross-wind landings.

In a drift landing, the machine has a lateral motion relative to the ground at the instant of landing. If, for example, the wind is from the left, the machine touches the ground with the wheels receiving a force from the right. This tends to tip the right wing, and at the same time to introduce a yawing couple owing to the lateral force on the front wheels. This is a very frequent cause of ground looping when rudder is not used with sufficient alertness. The situation can be remedied somewhat by using a non-castorable rear wheel, and also by placing the main wheels in rear of the center of gravity. With suitable redesign of the landing gear it is conceivable that a drift landing could be made with no rudder in operation.

On the other hand, the cross-wind landing has to be given equal consideration. Cases might arise where a cross-wind landing has to be made so that at the instant of landing the machine has no lateral motion relative to the ground. This may be accomplished by coming down with a side slip. Thus, if the wind is from the right, the machine should be banked right wing low. The problem, therefore, is to maintain right bank and right side slip without turning (leveling out laterally at the instant of landing). With a three-control machine, it would simply be a question of holding right aileron so as to counteract the effect of the dihedral, and left rudder to counteract the positive yawing moment due to side slip.

If only ailerons were available, the maneuver would only be posible with "adverse" yawing moment, and even then its execution would be very difficult.

A Review of the Situation

The above analysis is elementary and qualitative only. A thorough theoretical analysis is a matter of considerable complexity, yet assuming that ailerons with any desired yawing moment characteristics can be obtained, it is possible to note some tentative views.

1—Any airplane which is to be operated with only two controls must have very large vertical tail surfaces and very large dihedral, properly correlated.

2—In the case of lateral or directional disturbances, a machine so designed for maximum lateral stability could probably take care of itself for the most part. Recovery, with only two-control operation can never be as rapid and as clear-cut as when three controls are available. The provision of ailerons with "favorable" yawing is not the sovereign provision for the correction of lateral disturbances when no rudder is available. In some disturbances "adverse" yawing moment, in other disturbances "favorable" yawing moment would be desirable.

3—The now recognized 1-2-3 system for blind flying becomes difficult to apply.

4—In the initiation of a turn, ailerons with "favorable" yawing moment (accompanied by large vertical tail surfaces) are definitely preferable to ailerons with "adverse" yawing moments, and also preferable to a system where rudder alone is employed. This practically answers the question whether we should see two-control with ailerons or with rudder.

5—A steady turn may best be maintained with ailerons having an "adverse" yawing moment; the turn is best started with ailerons having a "favorable" yawing moment. This contradiction in requirements constitutes a difficulty.

6—If a two-control system is employed, there will be either skidding or slipping on the turn. The possibility of a "perfect turn" vanishes. The question of stability in circling flight will have to be reexamined very carefully.

7—If ailerons with "favorable" yawing moment are to be employed in two-control, the desirable amount of moment will have to be the object of careful research.

8—Whatever system of two-control may be employed, there will be an important limitation on the maneuverability of ordinary flying, and a number of maneuvers will become impossible.

9—Whatever system of two-control is employed, the question of control at the stall and freedom from the incipient spin will be a difficult one. Just as in ordinary flying, in some disturbances "favorable," in other disturbances "adverse" yawing moments will be desirable at the stall.

10—On the whole, a two-control system with ailerons is preferable to a two-control system with rudder. If the rudder is eliminated, recovery from the spin will be more difficult.

11—While changes in landing gear design may decrease the hazard of ground looping without rudder in drift landings, cross-wind landings would be only possible with "adverse" yawing moment, and even then would be a difficult matter. A ship without rudder is always less free from the possibility of ground looping.

On the other hand, the possibility of two-control operation for private flying is fascinating. Nothing would so quickly stimulate private flying as the removal of the irritating and difficult coordination of rudder and aileron. It is sincerely hoped that the Bureau of Air Commerce and the N.A.C.A. will continue their efforts along these lines. But, the difficulties set forth in this article should be squarely faced, and carefully investigated by tunnel and full flight research and careful mathematical analysis.

Flight Lieut. Atcherly demonstrating an improper cross-wind landing

Aeronautical Patents

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Airplane wing. Harry A. Douglas, Bronson, Mich. (1,990,473)

Shafting for power transmission (in aircraft). Hugo Junkers, Dessau, Germany. (1,990,606)

Variable-pitch propeller. Lizandro F. Castro, San Francisco, Calif. (1,990,814)

Ice overshoe for aircraft. David Gregg, Caldwell, N. J., assignor to Eclipse Aviation Corp. (1,990,866)

Irreversible control. Edward R. Child, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (1,990,978)

Airship. Eberhard Lempertz, Friedrichshafen, Germany, assignor to Luftschiffbau Zeppelin G.m.b.H. (1,990,993)

Braking device for aircraft catapults. Hans Herrmann, Kiel, Germany. (1,991,212)

Method for automatic control of aviation engines. Emil Schimanek, Budapest, Hungary. (1,991,296)

Wing rotor. Johannes Christiansen, Sorup-Schauby, Germany. (1,991,378)

Combination airplane and helicopter. William H. Russell, New Haven, Conn. (1,991,466)

Wing construction. August Bauer, Brooklyn, N. Y. (1,991,651)

Course and distance indicator. William G. Gerlach, Oakland, Calif. (1,991,665)

Rotative wing aircraft. Walton V. D'A. Rutherford, London, England, Raoul Hafner, Vienna, Austria (1,992,015)

Control apparatus for airplanes and other dirigible objects. Frederick W. Meredith, South Farnborough, and Philip A. Cooke, London, England. (1,992,086)

Airplanes. Randolph F. Hall, Rochester, N. Y. (1,992,157 and 1,992,158)

Propelling device for aircraft and like. William Stelzer, Chicago, Ill., assignor to Bendix Aviation Corp. (1,992,333)

Propeller blade and method of making. Stanley Whitworth, South Bend, Ind., assignor to Bendix Aviation Corp. (1,992,338)

Airplane wing structure. Francis S. Welman and Arthur Levell, Bexley Heath, England. (1,992,560)

Method and apparatus for radio beacon course and quadrant identification. Francis W. Dunmore, Washington, D. C., assignor to Government of the United States. (1,992,927)

Electric rudder control contacting device. Charles D. Fator, U. S. Army, Wheeler Field, Hawaii. (1,992,929)

Airplane construction. Harlan D. Fowler, San Francisco, Calif. (1,992,941)

Hydropneumatic automatic pilot. Elmer A. Sperry, Jr., Brooklyn, Bert G. Carlson, Queens Village, and Mortimer F. Bates, Brooklyn, N. Y., assignors to Sperry Gyroscope Co. (1,992,970)

Balancing standard for propeller blades. James H. McKee, Pittsburgh, Pa., assignor to Pittsburgh Screw & Bolt Corp. (1,993,218)

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Engineering Training

The Training of an Aeronautical Engineer, A. J. Sutton Pippard. Royal Aeronautical Society Journal, Vol. 39, *No.* 290, *February,* 1935, *pp.* 63-74 *and* (*discussion*) 74-108.

IDEAL TRAINING for an aeronautical engineer and the function of the university are discussed. The author believes that the school education of the future aeronautical engineer, up to the time when he passes a matriculation examination, should be on a broad basis free from vocational training while the technical or scientific training may either follow or precede works training. He recommends that practical training be given in an airplane or engine construction plant, so organized that a working knowledge of all branches may be obtained in as short a time as possible.

The discussion following the paper is of particular interest as it gives the views of leaders in the British aeronautical research and the aircraft industry, including those of L. Bairstow, H. E. Wimperis, C. R. Fairey, R. V. Southwell, Cave-Browne-Cave, and D. R. Pye. K. G. Merriam compares the curriculum suggested by Professor Pippard with that in use at Worcester Polytechnic Institute.

Tandem Propellers

The Efficiency of Tandem Propellers (*Sul rendimento delle eliche in tandem*) *M. Panetti. L'Aerotecnica, Vol.* 14, *No.* 12, *December,* 1934, *pp.* 1365-1370, 16 *equations.*

FORMULAS ARE given for calculating the efficiency of propellers arranged in tandem, the average axial and peripheral increment being considered. Two possible combinations are taken up, in one case with the propellers located far apart and in the other very near to each other. In the first case, it was found that only the rear propeller experienced the axial and peripheral increment due to the front propeller but in the second case both experienced the disk axial increment produced by the other. The author concludes that there is always a loss of efficiency due to the operation of the rear propeller, or of both propellers, in the slipstream and that this loss cannot be decreased or nullified by the action of the peripheral increment on the rear propeller rotating in the opposite direction.

Aircraft Production

Aircraft Production Methods, W. G. Gibson. Royal Aeronautical Society Journal, Vol. 39, *No.* 289, *January,* 1935, *pp.* 31-44 *and* (*discussion*) 44-46, 9 *figs.*

MAJOR FACTORS entering into the cost of producing metal airplanes, such as building, plant, design, labor and administration charges are discussed and production methods employed in the Westland Aircraft Works are compared with those in use elsewhere. Various types of spars and ribs are described and their advantages from a production as well as strength/weight ratio pointed out. In regard to fuselages, the author believes that, up to a certain size, the riveted tubular type is the cheapest while for planes of above 6,000 pounds in weight the monocoque fuselage could be made as cheap a production job as the framed and fabric covered type. He urges the simplification of design and the further development of welding and suggests that money be spent on manufacturing research as well as aerodynamic.

Aerodynamics

Boundary Layer Theory, Hilda M. Lyon. Aircraft Engineering, Vol. 7, *No.* 72, *February,* 1935, *pp.* 32-36, 7 *figs.*

RESULTS of research work in various laboratories are reviewed with examples of the type of problem for which a study of the flow in the boundary layer has proved of value. The author shows that there is considerable scope for further investigation into the reasons for the effects of Reynolds number, turbulence, and surface roughness on the aerodynamic characteristics of different wing sections.

She points out that the explanation for the behavior within the boundary layer, merely from an examination of the lift and drag coefficients for a wing of finite aspect ratio, is complicated by the fact that the center part stalls before the wing tip. She recommends measurements of the pressure distribution over the center of the wing extending completely across the tunnel, in conjunction with force measurements on the center section only, and also suggests measurements of total head within the boundary layer, or some other method for determining the relative position of the transition and separation.

Pratt & Whitney's Development of the Two-Row Radial Aircraft Engine

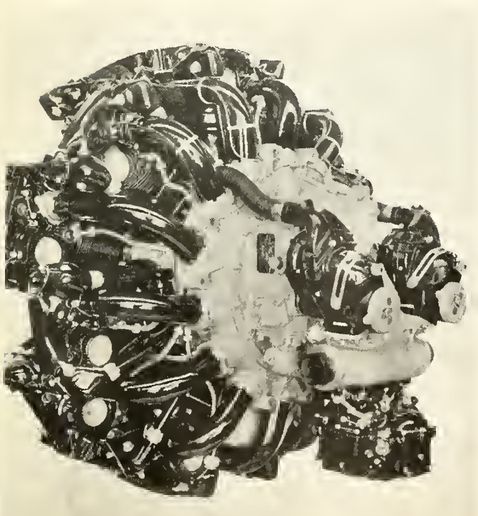
CHARLES H. CHATFIELD

Chairman, Technical Advisory Committee, United Aircraft Corporation

Within the last year, the two-row radial air-cooled engine has become available in quantity in the United States as an airplane power plant of high output. This article is devoted chiefly to a discussion of the characteristics of that engine as compared with those of the single-row engine.

The development of the two-row radial engine as a power plant for airplanes goes back to the period before the World War when Anzani and several other engine builders worked on small engines of that type. Soon after the war, Armstrong-Siddeley in England took up the manufacture of two-row radials, beginning with engines of moderate powers and going on in recent years to large ones. In 1928, Curtiss Aeroplane & Motor Company, Inc., brought out a six-cylinder two-row radial engine which enjoyed a period of extensive commercial use.

Some six years ago, The Pratt & Whitney Aircraft Co., realizing that more than nine cylinders were necessary for engines of high power, built an experimental 14-cylinder two-row engine with a piston displacement of about 2300 cubic inches. The results of dynamometer and flight tests of this engine in 1929 and 1930 encouraged the company to undertake the general development of the two-row type, but since none of the American airplanes built or contemplated at that time required so large an engine the experience gained with this engine was utilized in the development of a two-row engine of 1830 cubic inches, the Twin Wasp.



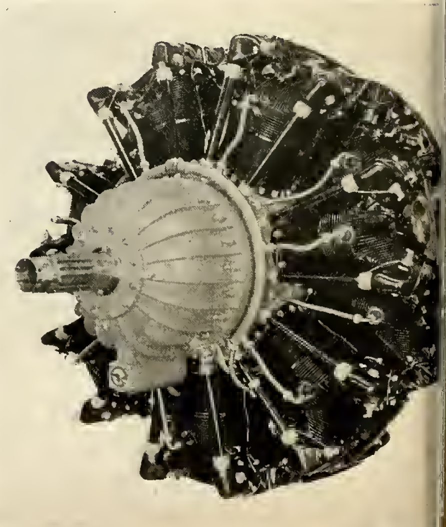
Three-quarter rear view of a Pratt & Whitney two-row radial engine

In the latter part of 1930, the Bureau of Aeronautics of the United States Navy Department became interested in the two-row type, and, at its request The Pratt & Whitney company and others began work on smaller two-row engines, with displacements of about 1520 cubic inches. In 1934, the developments of Pratt & Whitney had reached the stage where both the Twin Wasp engine and its smaller counterpart, the Twin Wasp Junior, were put into production. A number of these engines are already in service, and more are to be installed in new airplanes that will appear this year. The present, therefore, appears to be an opportune moment for considering the possibility that in the field of higher powers the two-row radial engine will supersede the single-row type.

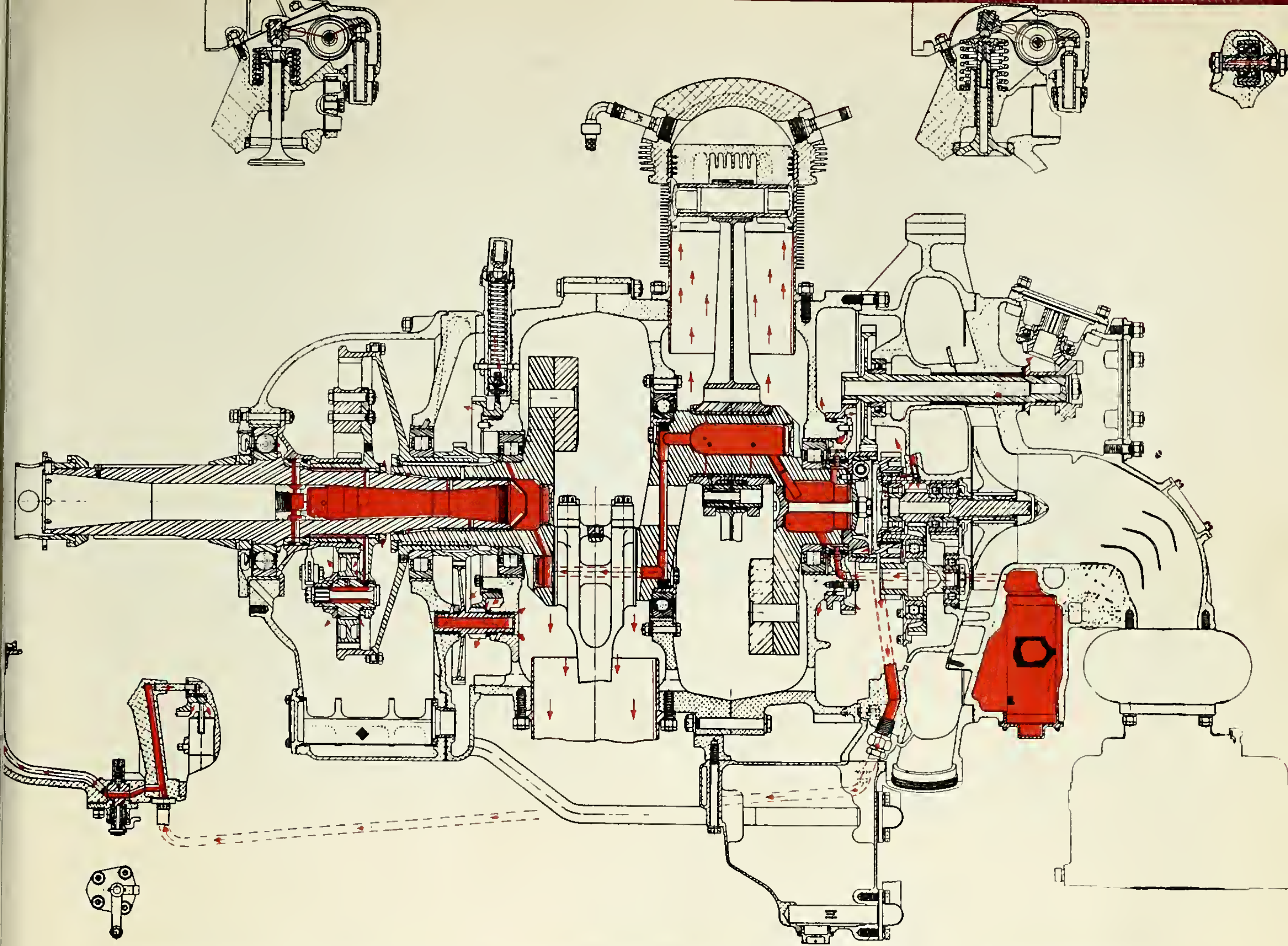
Of the two Pratt & Whitney two-row engines now in production, the Twin Wasp Junior, has a displacement of 1535 cubic inches, and (as already mentioned), the larger, the Twin Wasp, is of 1830 cubic inches. Both engines have 14 cylinders arranged in two staggered rows of 7 each. In general design, these engines are much alike, and, except for differences in crankshafts, master connecting rods, and cam mechanisms, they are of the same general construction as the single-row Pratt & Whitney engines. The front cylinders of the two-row engines, together with their valve gear, resemble very closely the cylinders of the single-row engines, while for the rear cylinders the cams and valve gear are behind instead of in front, with corresponding modifications in the cylinder heads. The larger of the two engines is generally rated at 800 h.p. at 7000 ft., and the other at 700 h.p. at 8500 ft.

In view of the need for relatively low propeller speeds for best efficiency at high powers, the Twin Wasp engine is made only with geared propeller drive, and that drive is preferred for the Twin Wasp Junior.

In one case, a direct comparison between corresponding two-row and single-row engines is possible, for in power and rated altitude the Twin Wasp Junior engine is substantially equal to the single-row Hornet, this despite the fact that the piston displacement of the latter is the greater by ten per cent. The higher permissible crankspeed of the two-row engine offsets not only the difference in displacement, but also the effect of a difference in brake mean effective pressure that at the moment is in favor of the single-row engine. It is to be expected, however,



Three-quarter front view of the Pratt & Whitney two-row Wasp Junior



Longitudinal section of the Twin Wasp and Twin Wasp Junior engines showing flow of presssure oil in the lubrication system

that the normal course of development will before long result in making the mean effective pressure of the two-row engine at least equal to that of the single-row, and possibly greater.

Even under present conditions, the weight of the geared Twin Wasp Junior engine is a little less than that of the geared Hornet.

Early fears that good mixture distribution might be difficult to obtain in the two-row engine, or that its mechanical efficiency might be low, have not been realized; as a matter of fact, the result, both of dynamometer and of flight tests, have tended toward better specific fuel consumptions for the two-row engine than had previously been obtained with the single-row under corresponding conditions.

Operating Characteristics

In common with internal combustion engines in other fields, the two-row radial aircraft engine exemplifies the improvements in operating characteristics which follow from an increase in the number of cylinders. One of these operating improvements is in general smoothness and freedom from vibration. Thus with the two-row engine the effects of repeated stresses on the airplane structure are minimized, with consequent diminution in maintenance difficulties and in the detrimental consequences of transmitted vibration. This last circumstance naturally means not only more comfort for the occupants of the airplane but also more reliable functioning of instruments and auxiliary equipment.

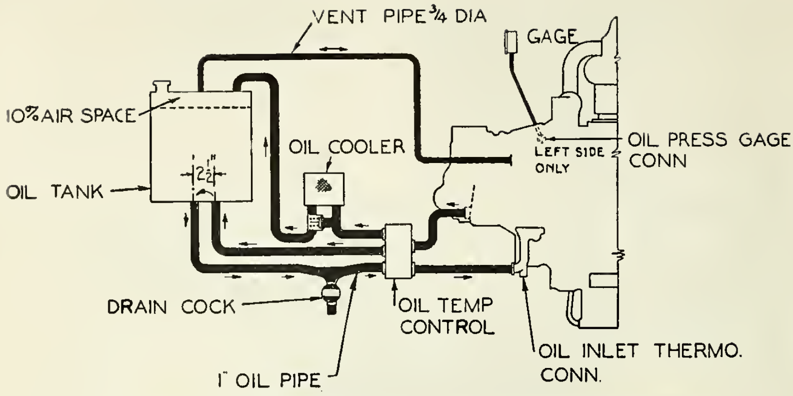
The fact that, as compared with the single-row engine, the two-row has more and smaller cylinders results in a second important advantage—that of a reduction in the stresses in the propeller that are produced by the explosion impulses. As these stresses are often the critical ones in determining the sizes of propeller parts, the result is that for a given engine power and propeller speed the weight of the propeller for the two-row engine may safely be less than that for the single-row engine.

There are already definite indications that, of two engines of equal power, the two-row is less noisy due partly to the smaller cylinders, with resulting decrease in the energy of the individual exhausts, and partly to the higher frequency of the exhaust noise which makes it less objectionable in character.

Engine Cost and Maintenance

It is not surprising that, at any rate for the present, the larger number of cylinders makes the two-row engine more expensive than the comparable single-row engine. The ratio of cost is now on the order of 14 to 9, but with increasing production it will undoubtedly become less. Here, however, it should be mentioned that the use of smaller cylinders and the smooth running characteristics of the two-row engine warrant the expectation both of a longer total life and of longer intervals between overhauls than in the case of the single-row engine, thus to some extent offsetting the differences in first cost and in the cost of individual overhauls.

In the servicing required from day to day, the difference between the single-row and the two-row engines is less than might be expected, chiefly because this



Diagrammatic sketch of the oil system of a two-row P. & W. engine

servicing has consisted largely of valve gear lubrication, and the development of the automatically lubricated gear has diminished this item of labor so much, both for the single-row and for the two-row engines, that the difference in this respect between the two is relatively small.

Cooling

When the development of large two-row engines was first undertaken, it was feared that it might prove very difficult to cool the rear cylinders adequately. Fortunately, however, the contemporaneous development of the close or pressure-type of baffle so reduced the quantity of air required for cooling that it has become relatively easy to insure to the rear cylinders an adequate flow of air that has not been heated by contact with the front cylinders. Another recent development in engine cooling, the controllable cowl, has made it possible to obtain an adequate total flow of air, even under difficult conditions, such as in climb, and at the same time to reduce both the air flow and the resulting drag under the easier cooling conditions of cruising.

The dimensional relations between the cylinders of single-row and those of the two-row engines tend toward inherently better cooling characteristics for the latter, since in relation to heat to be dissipated more cooling surface is available in the smaller cylinders than in the larger ones.

Engine Dimensions

Although the overall length of the two-row engine is somewhat greater than that of the corresponding single-row, this disadvantage is offset by a reduction in overall engine diameter, which, in a typical case, amounts to about 20 per cent; this corresponds to a reduction in frontal area of about 35 per cent.

Several favorable characteristics of the two-row engine are due to this small overall diameter. One of the most apparent of these is the improvement in visibility especially in single-engine machines. Another consequence of the smaller diameter of the two-row radial engine, is a reduction in drag, and, thanks to the improvements already mentioned in cowls and baffles, this improvement in engine drag characteristics does not have to be bought at a sacrifice in cooling characteristics. The effect of the reduction in engine drag on airplane performance naturally depends on the design of the airplane; it is greatest in fast machines of clean design, especially those with small fuselages or nacelles, and is least in airplanes of such design that engine drag constitutes a relatively small part of total drag.

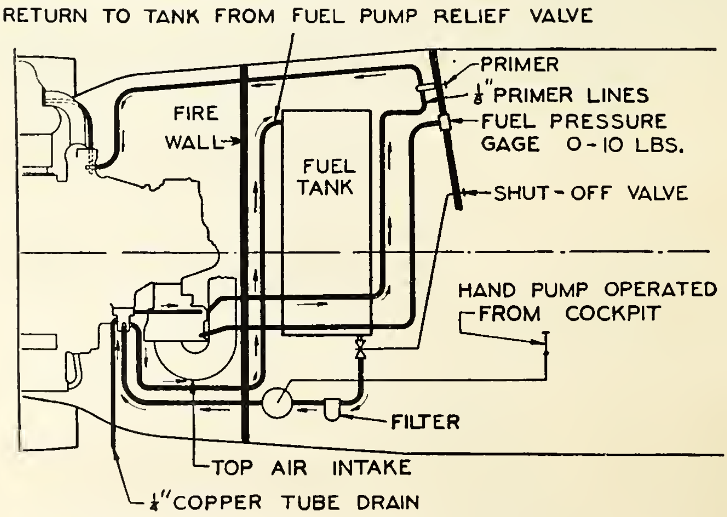
Propulsive Efficiency

A third beneficial effect of the reduced diameter of the two-row engine as compared with that of the single-row is an improvement in propulsive efficiency, assuming, of course, that both the single-row and the two-row engines have geared propellers. For a typical case, this improvement in propulsive efficiency amounts to about two per cent, both at maximum speed and at cruising speed, thus diminishing by that amount the fuel required for a flight of given distance at a given airplane speed. Alternatively, the improvement in propulsive efficiency may be utilized to increase the maximum speed of the airplane.

Comparative Low Weight

An incidental advantage of the small diameter of the two-row engine is that it offsets the effect of the larger number of cylinders on the weight of cooling baffles and of exhaust collector, with the result that the combined weight of cowling, baffles, and exhaust collector is no greater for the two-row engine than for the corresponding single-row.

It should be noted that comparisons between the two-row engine and a single-row engine of equal power do not tell the whole story, for the constant demand for increases in the power of aircraft engines has brought the single-row engine to a point where the limitations imposed by increases in cylinder size and in brake mean effective pressures are close at hand. With the two-row engine, however, these limitations are still far enough away so that they do not operate as a serious restriction on engine development, and with the two-row engine it should be possible to continue for a considerable period to meet the requirements for higher powers without sacrificing the advantages of the air-cooled radial that for so long have made it the dominant type among airplane power plants in this and many other countries.


RETURN TO TANK FROM FUEL PUMP RELIEF VALVE
PRIMER
⅛" PRIMER LINES
FUEL PRESSURE GAGE 0-10 LBS.
FIRE WALL
FUEL TANK
SHUT-OFF VALVE
HAND PUMP OPERATED FROM COCKPIT
FILTER
TOP AIR INTAKE
¼" COPPER TUBE DRAIN

Diagrammatic sketch of the fuel system of a two-row P. & W. engine

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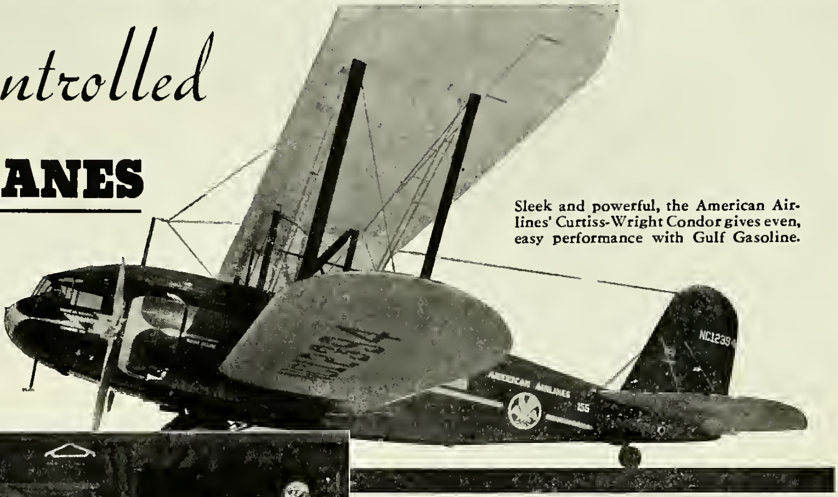

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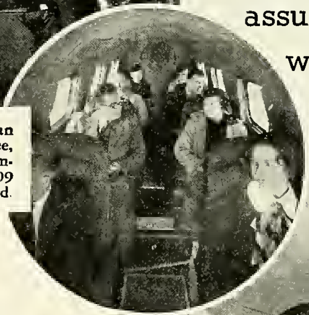

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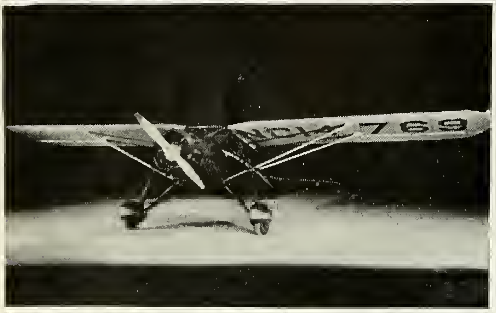

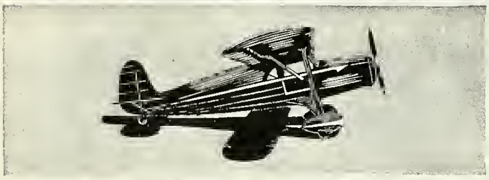

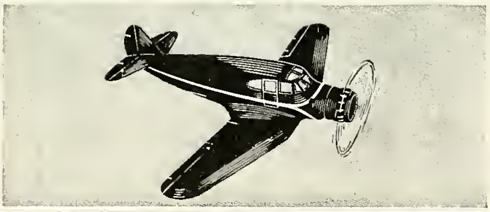

● *Fairchild "24"—Warner-powered . . .*

outstandingly popular since its introduction a year ago. This 1935 model establishes even more distinctive standards of quality craftsmanship and flight characteristics unequaled among cabin airplanes. Features 120 M. P. H. cruising with 145 H. P., carrying 3 persons and 237 lbs. of baggage and accessories with a cruising range of 490 miles, or 12.6 miles per gallon. Proclaimed internationally as finest constructed airplane ever manufactured for private owner use. Ball-bearings for all movable parts, anodizing and cadmium plating of all metal units, electric starter, battery, navigation lights, wheel pants, ash trays, assist cords, sun shades and many other luxuries add to cross-country comfort, flight efficiency and durability.

● *Fairchild "24"—Ranger-powered . . .*

this Fairchild engineered engine now available in this popular model. The Ranger engine features unexcelled visibility, exceptional smoothness and practical elimination of 20-hour checking because of internally-lubricated valve mechanism. Fairchild quality makes this combination of plane and engine most attractive.

● *Fairchild "22"—Warner-powered . . .*

one flight in this ship will literally amaze the expert as well as the novice pilot. Unusual agility produced by extremely responsive aileron control is combined with a ruggedness of construction that instantly invites a complete routine of aerobatics. Extreme stability, even in complete stall position, makes it an ideal plane for any kind of flying . . . no matter how advanced, or elementary. Used for military training purposes and by sportsman fliers who choose carefully to obtain the finest in engineering and precision workmanship. The same construction features found in the "24" are incorporated in this splendid 2-place sport plane.

● *Fairchild "45"—Jacobs-powered . . .*

soon to establish new standards in high speed personal cabin planes. A full cantilever low-wing with retractable gear, carrying 5 passengers and 200 lbs. of baggage plus full equipment; 155-160 M. P. H. cruising, 48 M. P. H. landing with flaps; interior refinements and luxuries ultra-complete in all details. This Fairchild is destined to establish new trends in the larger cabin classification and will be generally available for early summer deliveries.

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Fairchild quality construction prevents invasion of the lowest price fields, but the same ball-bearing control system, corrosion proofing, mirror-like finish, instruments, precision workmanship and durability found in larger Fairchilds make this plane most economical for sport and training because of lower maintenance and longer life. Using only 5½-6 gallons per hour and cruising at 95 M. P. H. this ship offers operators a splendid opportunity to increase training activity by offering a truly fine airplane to students. Extreme shock absorption and wide tread landing gear equipped with brakes ideal for elementary training. Exceptional strength permits advanced work of all types. Initial cost surprisingly low. Write for details, naming model in which you are interested.

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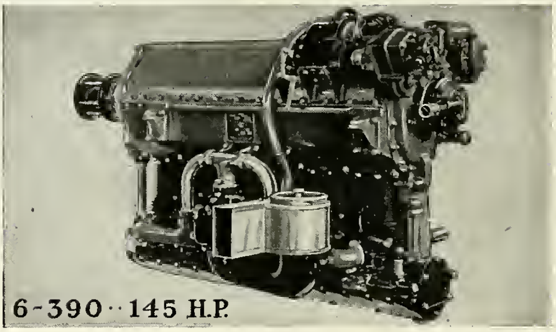
• In-line Air-Cooled Engines

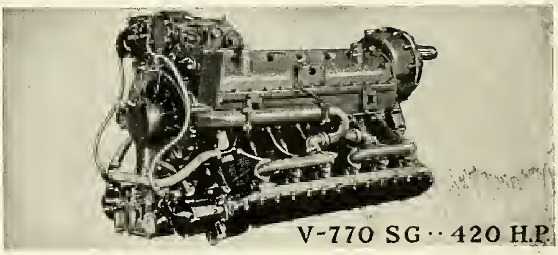


6-390 · · 145 H.P.

After four years of intensive developing, testing and flying, a new series of in-line, air-cooled engines has been perfected. Available in power classifications ranging from the 145 H. P. six cylinder to a 420 H. P. geared and super-charged 12 cylinder V-type, these engines feature low frontal area, extreme smoothness and elimination of periodical servicing. The valve mechanism is completely enclosed and internally lubricated. Except for magnetos, there is nothing to oil or grease; excepting the spark-plugs, no maintenance or checking is required between major overhauls.

These engines have had extensive flying in several types of planes. Chas. Ward Hall, manufacturer of large flying boats for the U. S. Navy, states: "The 6-390 Ranger engine in my plane has been extremely satisfactory. To date it has had about 400 total hours and has required no repair work beyond removal of spark plugs and cleaning of magneto points. Compression still seems uniform for all cylinders and the power delivered the same as when new. No engine trouble of any kind has occurred during any flight and its smooth running qualities at any r. p. m. have been frequently the subject of comment by qualified passengers."

The Ranger Engineering Corporation, a Fairchild subsidiary, is fully equipped with latest type machinery and manufacturing facilities, and in a position to concentrate on the design and manufacture of large, high performance engines endowed with Fairchild quality and precision craftsmanship.



V-770 SG · · 420 H.P.

RANGER ENGINEERING CORP.

Farmingdale, L. I. New York

Ranger's Program in the Field of In-Line Air-Cooled Engines

●

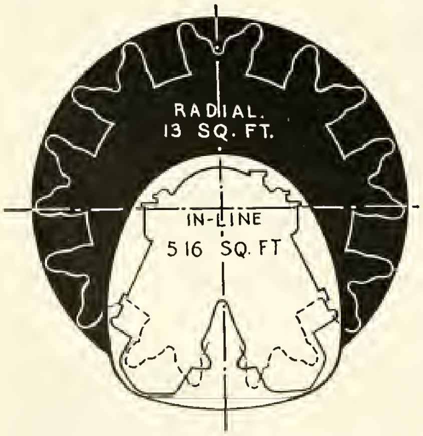
DUNCAN B. COX

Vice-president, Ranger Engineering Corporation

● The announcement by the Fairchild Aviation Corporation that some models of its popular line of commercial airplanes will now be equipped with its own engines in addition to other well-known makes marks a major change in policy on the part of one of the dominant companies in the private-owner market. Fairchild's development of inverted, in-line, air-cooled engines was originally started in 1929 and is now organized under Ranger Engineering Corporation, which has been for the past year active in this field at its factory in Farmingdale, L. I., N. Y.

The factory, originally built by the former Fairchild Engine Corp., was equipped in 1931 with the most modern facilities for the manufacture and testing of in-line engines. Title to the plant was acquired by The Aviation Corp., under the reorganization through which the Fairchild Aviation Corp. became independent of its former parent company, The Aviation Corp. The factory and the entire development is now back under the original management, and the old personnel has to a major extent been reassembled and is again headed by Walter F. Davis, Chief Engineer. The program under way calls for an engineering organization which will rank in efficiency with that of any aircraft engine manufacturer.

The company will concentrate its entire interest on air-cooled in-line engines. The first model to be commercially available is the Ranger 6-390-B, an inverted, air-cooled, six-cylinder engine, rated 145 horsepower at 2250 r.p.m. by the Department of Commerce under an approved type certificate. The Fairchild "24" for 1935, latest of Fairchild three-place cabin airplanes, will be optionally equipped with this engine or with the 145 h.p. Warner.



Ranger V-770-SG and radial engine of equal power; front elevation and coincident propeller axes

The Ranger 6-390-B is rated by the Department of Commerce at 145 h.p. in order to conform to the power requirements of the Fairchild "24." All of the development, running and the final Department of Commerce testing was accomplished at 2400 r.p.m. and at more than 155 corrected h.p., the actual h.p. being in excess of 165. The same 6-cylinder engine has been successfully tested with supercharger at a series of higher powers up to 230 h.p.

The accompanying table is illustrative of the range of engines all incorporating the same fundamental design, the cylinder and valve assemblies being identical with those of the 6-390-B. Single starred models have Department of Commerce approved type certificates; on double starred models development has been completed; models triple starred represent reasonable potential development, without change in fundamental design and without use of special fuel. Specifications for models under development are preliminary.

In the smaller commercial models the primary objectives have been reliability, a minimum of maintenance, and lack of vibration. The in-line design with 6 cylinders is known for its inherent balance. It permits the use of a single camshaft operating rockers which bear directly on the valve tappets, eliminating the conventional long push rods essential on a radial. The absence of push rods maintains the valves at close to the same adjustment with the engine hot or cold, only .015" clearance being required. With the cam box cover serving as an oil sump, which provides a bath of oil for the entire valve mechanism, and with all moving parts automatically lubricated under pressure, the result is the reduction of necessary maintenance to a minimum. The use of an accessory drive shaft driven from the propeller end of the engine isolates from the accessories torsional crankshaft vibrations. The engines have built-in centrifugal oil cleaners.

Overhauls for the 6-390-B are recommended each 500 hours. This engine has been completely disassembled in less than an hour and the geared and supercharged 12-cylinder model has been disassembled completely to individual parts in an hour and 20 minutes.

In the military field, Ranger Engineering plans the attainment of a series of rugged training engines, a series of engines for special applications with powers between 450 h.p. and 620 h.p. and a high powered model with ratings between 840 and 1200 h.p.

In the field of training engines, Ranger's objective will be reliability and low maintenance expense. For this market, models with ratings between 145 and 300 h.p. are to be offered—all incorporating the same fundamental design and having 75 per cent of their parts interchangeable. These include two models for low cost primary training: the aforementioned 6-390-B, and the 6-390-BS with 175 h.p. at 2250 r.p.m. In these models the corresponding parts are identical with those of the geared and highly-supercharged models, and hence designed for horsepower outputs per cylinder of nearly double the rating for training purposes. This fact, plus the characteristic lack of vibration, permits reliable service over periods of 400 to 500 hours without any mechanical adjustments.

In the medium power field, Ranger's models with ratings between 420 and 620 h.p. are characterized by high power output per unit of frontal area. In the opinion of the writer, fighting and observation aircraft for use from Navy aircraft carriers must occupy as little space as possible, since the number of planes that can be carried on board is one of the determining factors in the carrier's effectiveness. This requirement is necessarily a handicap for carrier airplanes in competing in performance with Army aircraft. The solution does not lie in the use of larger engines, which inevitably

Model	Description	H.P.	Crankshaft r.p.m.	Displacement (cubic inches)	b.m.e.p.	Weight (pounds)
6-390-B*	Direct drive	145	2250	386.4	132	350
6-390-BS	Supercharged	175	2350	386.4	152	360
8-V-515-S	Supercharged	220	2250	515	149	410
8-V-515-SG***	Geared, supercharged	400	4000	515	161	410
12-V-770B**	Direct drive	300	2250	772.8	137	545
12-V-770-BS**	Supercharged	350	2250	772.8	159	565
12-V-770-SG*	Geared, supercharged	420	2800	772.8	154	625
12-V-770-SG	Geared, supercharged	450	3000	772.8	154	625
12-V-770-SG***	Geared, supercharged	620	4000	772.8	159	625
24-H-1540-SG	Geared, supercharged	840	2800	1545.6	154	1050
24-H-1540-SG***	Geared, supercharged	1240	4000	1545.6	159	1050

* Models with Approve Type Certificate.

** Models with Manufacturers Ratings.

*** Models under Development.

due to their size, require larger airplanes. A careful study of the problem has indicated that by the use of in-line, air-cooled engines, with frontal areas of less than one half that of the corresponding radial types, and by careful design for the specific purpose, carrier aircraft can be built which will at least equal in speed the larger, heavier, and higher-powered Air Corps equipment. With large radial engines there is no decrease in drag through the use of a fuselage smaller in maximum diameter than the diameter of the engine cowl, and this diameter is larger than needed to house the pilot and equipment. This results in a larger, heavier, higher-drag fuselage than with the in-line engine and also limits the pilot's vision at high angles of attack in deck-landings. With a 12-cylinder, inverted engine a small fuselage can be faired from a nose with an area of only about 5 square feet, against 13 square feet for existing 400 h.p. radial engines. There is the added advantage for the inverted, in-line engine of a high thrust-line which of itself improves visibility and balance with power on and power off, as well as reducing the necessary height of the landing gear.

The present Ranger model to meet the requirements for medium powers is a development of the geared and supercharged 12-V-770-SG, which holds Department of Commerce approved type certificate number 84 at 420 h.p. at 2800 crankshaft r.p.m. It is expected that the first of these new models will be rated at 450 h.p. at 9000 feet with 500 h.p. for take-off, the weight and the basic design remaining the same as that of the 12-V-770-SG. For special applications 600 h.p. should later be available. This power is well within the limits of brake mean effective pressures and r.p.m. already achieved in single cylinder, 6-cylinder, and 12-cylinder development work.

In the high horsepower field the same fundamental cylinder development and the same engine design used in the model 6-390-B and 12-V-770-SG have been used in the layout of a 24-cylinder *H* engine. This model will have a normal commercial rating of 800-900 h.p. with special ratings up to 1200 h.p. The engine will be much narrower than conventional radials, with a cowl width of only 35 inches. Although the cylinders are arranged in banks of 6, the engine is no longer than radials of corresponding power, due to the fact that in the radial design all of the accessories are mounted in the rear instead of on the side.

The following is a brief description of the Ranger model 6-390-B.

The crankshaft is of conventional, 6-throw, 7-bearing type, machined all over from a heat-treated, chrome nickel steel forging. Main bearing journals and crankpins are drilled for lightness and fitted with oil retainer plugs which act as centrifugal oil cleaners. These oil cleaners aid efficiency in operation, by eliminating the need for frequent changes of oil. They are cups into which the sediment is deposited and are easily cleaned.

Fairchild Ranger C-8-D

Oil circulation through the shaft is so arranged that stoppage at one point will not affect proper lubrication of all main and connecting rod bearings. The pressure feed to these bearings is so designed that each bearing is fed with oil from both sides so that if any line becomes clogged, the bearings continue to be fully lubricated. All moving parts, including the cam shafts, are lubricated by full pressure-feed from engine-driven pumps and there are no parts to be oiled manually, except the magnetos.

Connecting rods are machined from heat-treated, chrome molybdenum steel forgings, with the *I* section of the shank formed by a rolling process and kept to close limits to increase strength and eliminate the necessity for machining.

Trunk-type pistons are heat-treated, cast aluminum alloy, ribbed to provide strength and cooling. Three compression and one scraper ring are provided. Full floating-type piston pins are machined from heat-treated nickel steel held in place by spring steel wire lock rings.

The crankcase is of semi-elliptic cross section of heat-treated, cast aluminum alloy, the upper and lower halves being parted on the centerline of the crankshaft. The upper half carries, at the end of the 7 main bearings, 2 long studs which extend through the lower half case, act as dowels, and serve to clamp the 2 halves together. Both halves are ribbed to insure stiffness and strength, and the lower case is provided with 4 pads for attaching mounting brackets.

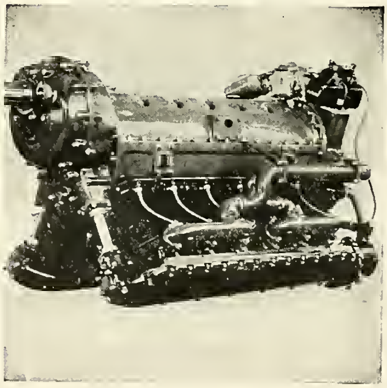
Cylinder barrels are machined from extruded heat-treated forgings of medium carbon steel and provided with integral cooling fins and mounting flange. The barrel is screwed and shrunk into the heat-treated, cast aluminum alloy cylinder head. Cylinder heads are provided with ample cooling fins, spherically machined combustion chamber, and single inlet and exhaust valves. Aluminum bronze valve seats and spark plug inserts are also shrunk into place. Adequate and uniform cooling is assured by a new design air scoop with inter-cylinder baffles.

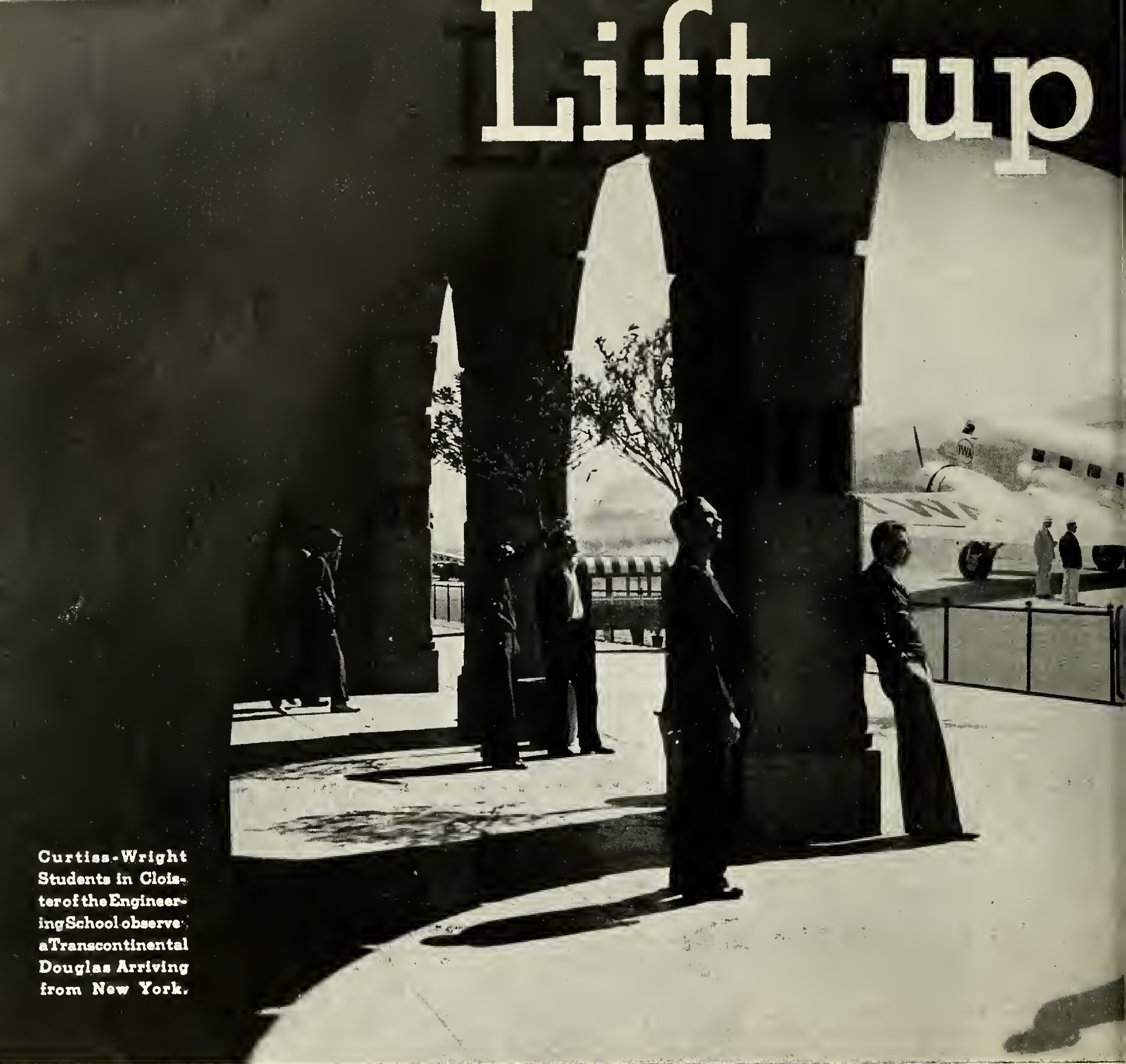
The valve gear is of the underhead camshaft type, fully lubricated. Actuating mechanism is completely enclosed in a cast aluminum housing, the cover of which serves as an engine oil sump. Cam timing is provided at the front end of the cam box by the removal of one small coverplate. Valves require no adjustment between overhauls because the valve mechanism is completely taken care of by pressure lubrication.

All accessories (except the starter) are driven by a flexible drive shaft geared to the front end of the engine directly behind the propeller, thus tending to eliminate the torsional vibration of the crankshaft on the gears. Accessories include oil pump, fuel pump, generator, two single magnetos, and two tachometers. Generator and fuel pump mounting flanges and drive are SAE standard, as are the tachometer drives.

●

Twelve-cylinder Ranger geared engine which delivers 420 h.p.





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NEW EQUIPMENT and METHODS

Anti-Vibration Aircraft Fuses

• ANTI-VIBRATION Littelfuses, designed to provide a high strength fuse, capable of withstanding severe vibration, are made in low and high voltage types applicable for airship and aircraft radio transmitters.

The low voltage types, for storage battery use, have a scientifically designed element punched from tempered zinc sheet and notched out to provide a place for fusion. A re-inforcing rib runs the entire length of the element and the sides are provided with supporting fins which fit snugly into the glass tube, thus preventing the element from vibrating as a separate unit. The most important anti-vibration feature, however, is a 90° twist given the element in the center, which increases the stiffness of the element almost three times, increases the natural period of vibration four times, and brings it above any period of vibration encountered in service and eliminates the possibility of sympathetic vibration. Cements for attaching the end caps have been eliminated and the end caps, glass tube, and fuse element are locked together with a special solder. These fuses are made in the standard 4 AG size (1¼" x 9/32" diameter).

The high voltage Anti-Vibration Littelfuses are fibre enclosed and are rated for 1000, 2500, and 3000 volt service. The elements are made of phosphor bronze, supported by aluminum bushings within the tube. They are principally used for radio aircraft transmitters.

Propeller Service Equipment

• AIR ASSOCIATES, Inc., has developed a number of propeller service units which enable the fixed base operator, manufacturer, air transport operator and service shops to accomplish any type of service, repair or straightening work on every type of propeller. There are 12 units available. The propeller service table is a heavily ribbed casting, the top of which is machined and provided with a spindle on which to mount the propeller hub. Various adapters are provided to fix different size propellers and an attachment is available for the blades while they are being twisted or straightened, so that no stress is placed on the spindle. A protractor sets angles to an accuracy of 1/10°.

Air Associates propeller service table

The balancing stand is a rigid cast metal frame with hardened steel balancing ways, and is large enough to swing the heaviest propellers. The hydraulic press is used for straightening blades bent beyond the limits which can be handled on the service table. Collets are provided to hold the various sizes of blades in the chucks at one end of the bed.

In addition to the above the company also manufactures grinding and polishing machinery for propeller work.

Battery-Cell Tester

• A TUNGAR battery-cell tester, featuring a special switch which permits its use either for high-rate-discharge tests or for open-circuit tests, has been announced by the General Electric Company's Merchandise Department, Bridgeport, Conn.

The body of the new cell tester is formed by a molded prod-handle shaped to fit the hand. A large meter, located at the top of the handle, has been imbedded in a wide shock absorbing rubber guard. Besides having the usual voltage scale, it is marked with special subdivisions which simplify battery-tests readings.

The special switch is of the thumb-screw type and is located between two cadmium-plated battery prods. By means of the switch, readings for both high-rate-discharge and open-circuit tests may be obtained from the same meter.

Lightweight Headphones

• COMBINING LIGHTWEIGHT with rigidity and strength, the Featherweight headset manufactured by Trimm Radio Manufacturing Co., Chicago, Ill., may be procured in impedances up to 24,000 ohms.

A 36% cobalt steel permanent magnet is used and, to prevent corrosion, coils are saturated with a special compound; all major metal parts are cadmium plated. The cord is moisture proof and the cap is designed to provide maximum comfort to the wearer.

Acoustically, the Featherweight type provides a high output without abnormal resonant peaks, is capable of delivering loud sounds without rattling or distortion, and will perform at any temperature. The headbands are available in several types including a type to be worn over a cap.

Portable Heaters For Engines

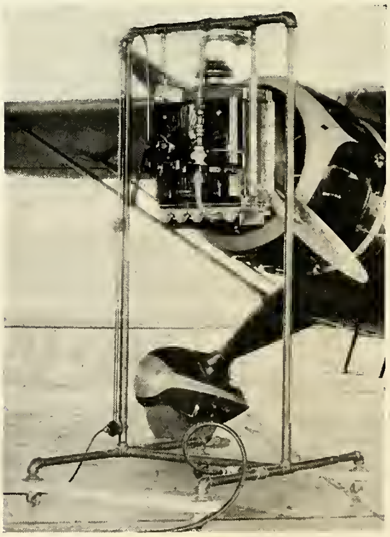
• UTILIZING A Humphrey Gas Heating Unit, C. W. Short, Jr., manager of the Tulsa Municipal Airport, has constructed a new aircraft engine heating device which saves considerable time in warming up an engine prior to take-off. This unit is placed on roller bearing wheels and can easily be moved up in front of the engine completing its warming process in from 5 to 10 minutes. In damp, wet weather when there is condensation, it will thoroughly dry out the plugs and magnetos.

The process fans hot air on the engine, and at the same time heats the oil to a temperature of 70° to 80°. The shutters on the heater are adjustable and can be used for any height engine.

Another portable heater is the Young electro-convection type manufactured by the Young Radiator Co., Racine, Wis. Especially designed for airlines and manufacturers, the heaters use an approved strip heater provided with extended fin surface for rapid heat transfer.

The heating element will operate at a maximum sheath of 500° F., and consists of a nickel chromium ribbon embedded in a refractory under hydraulic pressure. An automatic cut off connected in the circuit prevents overheating in the event of fan or motor failure.

These units can be used anywhere on the field, their utilization being regulated only by the length of the cable that is available.



Warming up an engine at Tulsa

Weather Forecaster

• ACCURATE FORECASTING of weather conditions from eight to fifteen hours in advance is said to be possible by a chemical weather device developed by Dr. Manfred Curry.

The device is inexpensive and simple, consisting of a hygrometer made of a chemical material that indicates the degree of moisture in the air by change of color. The instrument has an indicator, bearing five different colors ranging from blue which corresponds to a degree of from 0 to 20 per cent of humidity to bright red which corresponds to a degree of from 80 to 100 per cent of humidity.

The hygrometer changes color as the amount of moisture in the air changes. By moving the dial so that the color of the hygrometer matches the color of the indicator, and by shifting another handle which gives the direction of the wind according to a small compass set in the middle of the instrument, the forecast is shown in a slot set in the top of the disk.

Installing Valve Seat Rings

• A NEW outfit for counterboring cylinder blocks and installing valve seat rings, now being demonstrated by the Van Norman Machine Tool Co., Springfield, Mass., provides for counterboring the block, drifting in the ring and peening it securely in position.

Three tool bodies and nine high-speed steel blades handle ring recesses up to 3" diameter, and shims provide for cutting oversize recesses for replacement rings. The counterboring device which bolts to the block over a stud, employs a single cutter.

A standard Van Norman Expanding Pilot is used not only while counterboring, drifting and peening, but also while grinding the valve seat insert with the Van Norman Ro-to. It is stated that the use of the same pilot without resetting results in a gain in precision and that this feature, together with the single cutter and rigid construction of the cutter driving mechanism, permits working to extremely close limits of accuracy. A built-in gauge stops the hand-fed cutter at the proper depth.

A special drifting tool, for inserting the ring in the recess, and a special peening tool, for peening the metal of the block around the ring, are part of the outfit.

Timken Lock Nuts and Washers

• TO SIMPLIFY the problem of selecting lock nuts and washers for use with Timken Bearings, The Timken Roller Bearing Co. has prepared a series of charts listing lock nuts and washers. Full design details are given for the first two designs shown, and the nuts and washers listed can be used for the other three types of applications by making proper allowances.

The layout shown in Design 1 is intended for cases in which it is desired to have the maximum possible shaft extension diameter. Under this heading are listed all the cones suitable for the class of application, grouped under the largest thread that can be used with them.

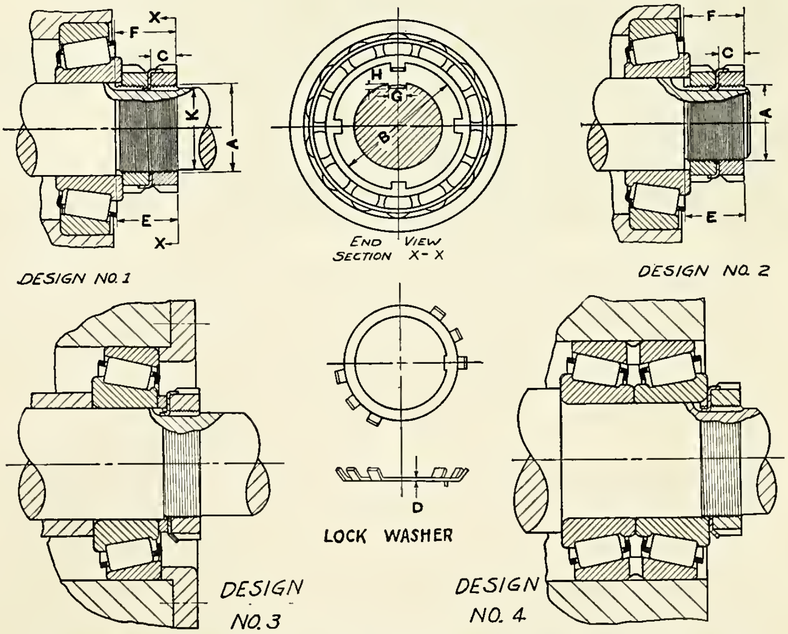
In the case of Design 2 the bearing cone has been selected for the nut listed on the basis of proper cone backing rather than thread diameter. In this case it is often possible to use a smaller size nut than would be used in Design 1, and at the same time secure the necessary cone backing. Fundamental dimensions for the nut and shaft are listed.

Design 3 covers applications where a single lock nut and tongued washer is used to clamp some other member or an assembly through the cones. In this case it is necessary to provide a small spacer between the front face of the cone and the tongued washer in order that the washer will not interfere with the bearing cage. In Design 4 a single lock nut and tongued washer is shown as used in connection with an NA Type bearing. In both designs the proper size nut to use may be quickly selected from the list, applying the dimensional qualifications detailed in Designs 1 and 2.

Two-Quart Pyrene Unit

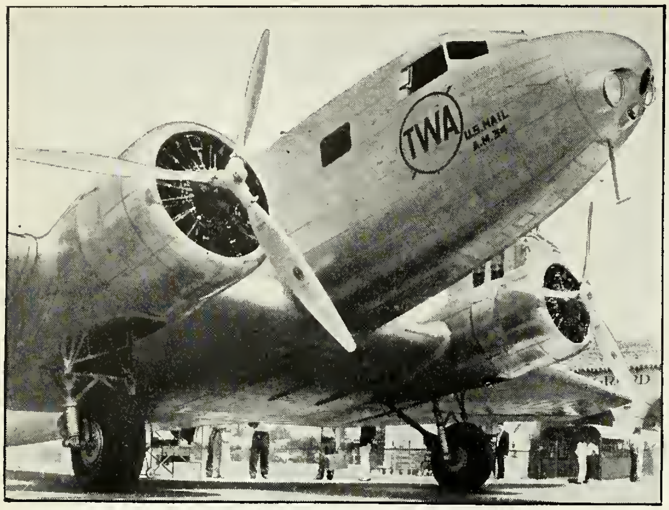
• A 2-QUART vaporizing liquid fire extinguisher that is discharged by air pressure and delivers a fan-shaped spray as well as a solid stream is now being manufactured by the Pyrene Manufacturing Company, Newark, N. J.

Constructed of copper and brass, the top and bottom castings are securely fastened to an inner and outer seamless shell, forming two chambers. The inner holds air under pressure, and the outer contains fire extinguishing liquid. To keep cost and weight low, no built-in pump is used, and consequently the air pressure is renewable at any air line having pressure of 100 lbs. or more. The extinguisher is compact, weighs 16.5 lbs. fully charged, is 18" high, and 5" in diameter. It is operated by opening the valve on the top and controlling the combination discharge nozzle, which produces a solid stream when opened wide, and a fan-shaped spray when opened partially.



Timken design chart for selecting types of bearings for lock nuts and washers

AROUND THE WORLD WITH



SOARING ACROSS AMERICA, under the TWA flag, Douglas Luxury Liners take giant 800-mile strides. Three flights each way daily — providing fast limited service between New York and Los Angeles via Kansas City and Chicago. All landings and take-offs are made on Goodrich Airplane Silvertowns.

DOUGLAS AIR GIANTS IN ALL PARTS OF THE GLOBE KEEP SCHEDULES, LAND SAFELY ON GOODRICH-PROTECTED WHEELS

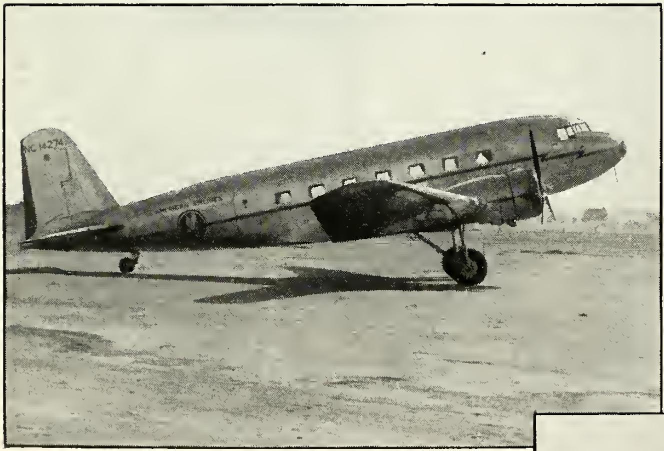
IT IS literally true that the sun never sets on Douglas Air Liners. Somewhere in the world Douglas planes take-off or land, practically every minute of the day . . . under many flags . . . guided by the pilots of many nations. They soar high over the bleakest outposts of civilization . . . drop down to the bustling airports of cities half a world apart.

Safety Guarded All the Way

On such far-flung air trails safety is never relaxed . . . in motors . . . planes . . . *or tires!* For Douglas, among many other *proven* safety features, equips all planes with Goodrich Low Pressure Tires. Not only for better protection of planes and passengers but also for the smooth take-offs and pillow-soft landings air travelers demand today.

Greater Strength in Tread and Carcass

The extra safety of Goodrich Airplane Silvertowns is not produced by *one* factor alone, but by many. Extra toughness of the tread is so important that Goodrich uses



(*Above*) **STREAKING ACROSS THE SOUTH,** Douglas transports fly American Airlines' route between New York and Los Angeles via Tennessee, Texas and Arizona. Multiple fast schedules are also flown between New York and Chicago. Besides offering speed and comfort to the transcontinental traveler, these planes protect passengers with every known safety device—including the use of Goodrich Airplane Silvertowns.

●

(*Right*) **SKIRTING THE EASTERN SEABOARD,** and serving Southern and Central States, Douglas Air Liners carry passengers safely and comfortably for Eastern Air Lines. As these planes cover 17,000 miles per day and make 100 landings, every 24 hours, much precaution must be taken in the use of tires. That's why Goodrich Airplane Silvertowns were chosen—for their ability to land with equal safety on the snow-covered fields of the north or on the hot sands of Florida.

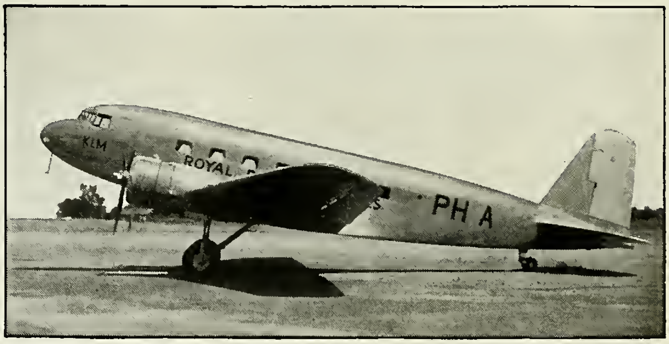
DOUGLAS ON GOODRICH SILVERTOWN TIRES!

only the toughest quality stock. It is needed to offset the scuffing action of wheels suddenly whipped to whirlwind speed in landing. And what other tire can compare with Silvertowns in all-around service? Silvertowns land with a "snowshoe" effect — a marvel for ironing out bumps and ruts. Coming down on sand, snow, soft or muddy fields is accomplished with far greater safety than on any other type of tire. No wonder Goodrich Silvertowns are asked to take full responsibility for the safety of heavy transports all over the world!

Equip Now

For greater safety, follow the lead of the principal air lines, pilots and plane makers. Equip your planes with Goodrich Airplane Silvertowns. See your nearest Goodrich dealer without delay, or write Dept. 504, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information about Goodrich Airplane Silvertowns and the 40 other Goodrich quality rubber products for airplanes.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS



HURDLING THE SOUTHERN BOUNDARIES OF ASIA
Douglas high-speed transports are proud to be selected as units of the Royal Dutch Air Lines' fleet connecting Amsterdam and Calcutta with far-away Batavia. For extra safety, the wheels of these planes are shod with Goodrich Airplane Silvertowns.

HOPPING THE EQUATOR, Douglas planes follow the sky trails of Pan American Airways. Shuttling between North and South America, they cross the cactus country of Mexico and plunge from the heat of Central America to the cold of South American mountain regions. Take-offs and landings on Goodrich Airplane Silvertowns mark the start and completion of their safe journeys.

40 OTHER GOODRICH AIRPLANE PRODUCTS

For airplanes, Goodrich makes everything from giant tires to the smallest grommet that ever guided a control wire—a complete line of time-tested accessories able to "stand up" in any job they get. Goodrich has engineered into *all* these products the same rugged toughness that makes Goodrich Airplane Silvertowns world-famous for safety. That, better than anything, tells why leading plane makers *also* select Goodrich rubber hose . . . tail wheels . . . De-Icers . . . over 40 products in all . . . for the safety of their ships.

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

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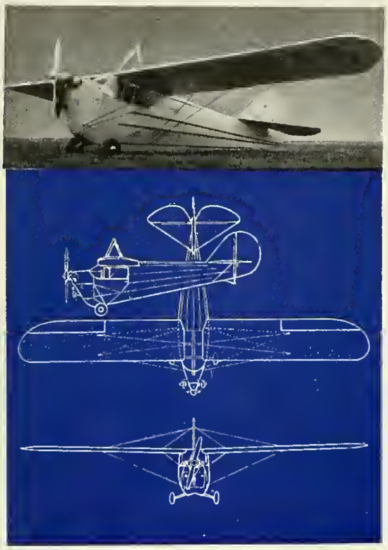


AERONCA C-3

Aeronautical Corporation of America, Cincinnati, Ohio

• President: Taylor Stanley. Vice-president: H. V. Fetick, General Manager: C. S. McKenzie, Jr., Sales Manager: J. C. Welsch. Chief Engineer: Roger E. Schlemmer. Export representatives: Howard T. Byler, Edificio A. Noite, Rio de Janeiro, Brazil, S. A. Messrs. Strachan & MacMurray, Iloilo, Philippine Islands.

Two-place high-wing monoplane. ATC 396. Aeronca E-113B engine, 36 horsepower. Span 36 feet. Length overall 20 feet. Height 7 feet 6 inches. Wing area 142.2 square feet. Chord 50 inches. Power loading 25.1 pounds per horsepower. Wing loading 7.06 pounds per square foot. Empty weight 569 pounds. Useful load 437 pounds. Payload 190 pounds. Gross weight 1006 pounds. Fuel capacity 8 gallons. Oil capacity .75 gallon. Maximum speed 93 miles per hour. Cruising speed 85 miles per hour. Landing speed 35 miles per hour. Service ceiling 12,000 feet. Rate of climb 450 feet per minute. Cruising range 200 miles.

Fuselage: welded steel tubing frame, integral engine mount, wood fairing, fabric covering; three longerons, with single longeron on top side; fin integral with fuselage. Wings: solid spruce spars with built-up spruce ribs, double drag wire bracing, fabric covered; supported by 4 lift wires on each side and 2 landing wires on top side; ailerons of dural corrugated sheet. Tail group: welded steel tubing, fabric covered; stabilizers and elevators interchangeable between right and left sides. Oleo type single-strut landing gear, equipped with 16 × 7 Goodyear tires, Goodyear wheels, and Aeronca oleo shock absorbers.

Standard equipment includes navigation lights, landing lights, cabin heater, compass, brakes and extra fuel tank.

Instruments: tachometer, oil pressure gauge, oil temperature gauge, altimeter, choke, throttle and ignition switch, automatic spark control, and first aid kit, fire extinguisher.

AIRCRAFT MECHANICS Model A-14

Aircraft Mechanics, Inc., Colorado Springs, Colorado

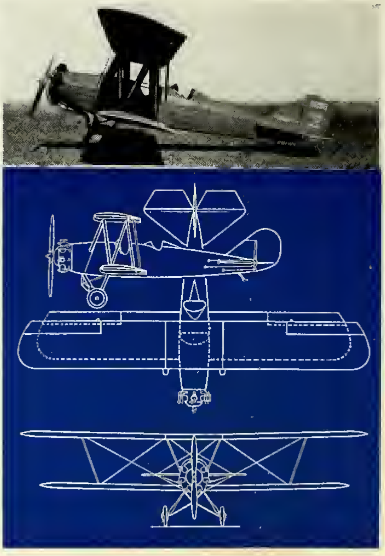
• President and Chief Engineer: P. W. Nichols. Vice-president: W. F. Theis. General Manager: V. A. Cheever. Sales Manager: U. H. Burfeind. Export representative: Aircraft Mechanics, Inc., Export Department, 44 Whitehall St., New York City, N. Y.

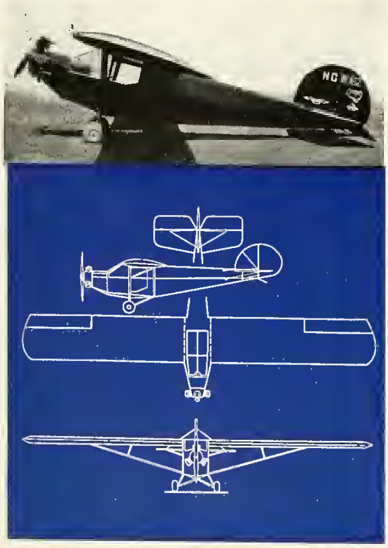
Three-place open biplane. Approval number 2-103. Wright J6-5 engine, 170 horsepower. Span 36 feet 8 inches. Length overall 25 feet 7.5 inches. Height overall 9 feet 10 inches. Wing area 287 square feet. Power loading 15.7 pounds per horsepower. Wing loading 7.85 pounds per square foot. Weight empty 1651 pounds. Useful load 937 pounds. Payload 340 pounds. Gross weight 2588 pounds. Fuel capacity 65.5 gallons. Oil capacity 5 gallons. Maximum speed 115 miles per hour. Cruising speed 95 miles per hour. Service ceiling 16,000 feet. Rate of climb 925 feet per minute. Cruising range 700 miles.

Fuselage: steel tubular welded, fabric covered; tandem seating arrangement with two persons in front; dual controls. Wings: spruce spars and ribs; fabric covered; no flaps; metal trailing edge; ailerons are box-beamed and wood-ribbed construction, fabric covered. Tail group: steel tubular construction, fabric covered; stabilizer adjustable in flight; fin is fixed. Landing gear: fixed split-type with 8.50 × 10 airwheels, Warner brakes and rubber cord shock absorbers.

Standard equipment includes wiring for navigation lights, opening on instrument board for compass, fuel cut-off, left or right throttle, baggage compartment, streamlined head rest, inspection windows, starter bracket, fire extinguisher, tie down ropes, first aid kit, cockpit covers, removable throttle handle, safety belts, adjustable stabilizer, Hamilton Standard propeller.

Instruments: altimeter, oil gauge, fuel gauge, temperature gauge, tachometer.





AIRCRAFT MECHANICS Model D-2

Aircraft Mechanics, Incorporated, Colorado Springs, Colorado

• Two-place high-wing monoplane. ATC 449. Szekely SR-3 engine, 45 horsepower. Span 37 feet 9.5 inches. Length overall 21 feet 8.5 inches. Height overall 5 feet 8.5 inches. Wing area 175 square feet. Chord 60 inches. Power loading 25.3 pounds per horsepower. Wing loading 5.5 pounds per square foot. Empty weight 589 pounds. Useful load 399 pounds. Payload 173 pounds. Gross weight 962 pounds. Fuel capacity 7 gallons. Oil capacity 1.5 gallons. Maximum speed 93 miles per hour. Cruising speed 77 miles per hour. Landing speed 30 miles per hour. Service ceiling 13,000 feet. Rate of climb 700 feet per minute. Cruising range 165 miles.

Fuselage: welded steel tubing, Warren truss type, fabric covered; Pyralin windows; side-by-side seating; dual controls; cabin dimension 5 feet long × 2 feet 6 inches wide × 3 feet 5 inches high; luggage compartment is behind seats; fuel tanks are installed behind the fireproof bulkhead; quickly removable engine mount. Wings: fabric covered wood construction, NACA M-6 section, fabric covered; rigidly-braced; supported above fuselage by system of steel tubular struts; two spruce box spars, I-section ribs, single drag wire bracing; narrow chord ailerons hinged to auxilliary spars. Tail group: steel tubular construction, fabric covered; wire braced; stabilizer adjustable in flight; fixed fin braced from stabilizer by a pair of streamlined wires on either side, the stabilizer being braced to fuselage by steel tube struts. Fixed divided-type landing gear consisting of two pyramids; equipped with Goodyear 16 × 7.3 airwheels. Swivelling spring steel tail-skid with hardened steel shoe.

Standard equipment includes wiring for navigation lights, cabin heater, large sliding windows, California or Supreme wood propeller, switch.

Instruments: tachometer, oil pressure gauge, oil temperature gauge, compass, altimeter.

Aircraft Mechanics, Inc., is continuing the work of the former Alexander Aircraft Co.

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● Year after year Berry Brothers leads the way in pioneering high quality aircraft finishes! Tireless research, new developments, and endless gruelling tests bring you the advantages of the most improved finishing systems at least one year in advance. Berry Brothers actually offers you 1936 aircraft finishes for your 1935 planes.

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The Kinner Airplane & Motor Corp.
The Douglas Aircraft Co.
The Grumman Aircraft Engineering Corp.
The Northrop Corp.
The Lambert Aircraft Corp.
The Lockheed Aircraft Co.
The Porterfield Aircraft Corp.
The Luscombe Aircraft Co.
The Fleet Aircraft Co. of Canada
The DeHavilland Aircraft of Canada Limited
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The Spartan Aircraft Co.
The Wiley Post Aircraft Co.
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The Government of Cuba
The Swissaire of Switzerland
The Fokker Company of Holland
Aeronautica d'italia
Aviation Division of the Fiat Motor Car Co., of italy
The Governments of Poland, Lithuania, and Norway
The Nyeri Aviation Service, Kenya Colony, British East Africa
The Governments of China and Java

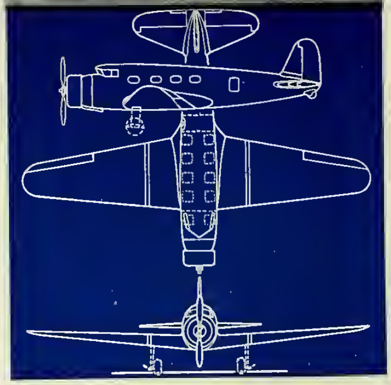
BERRY BROTHERS

PAINTS • ENAMELS VARNISHES • LACQUERS

DETROIT, MICHIGAN • WALKERVILLE, ONTARIO

VULTEE V-1A

Airplane Development Corporation, Glendale, California

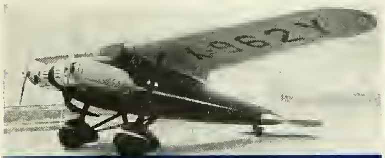


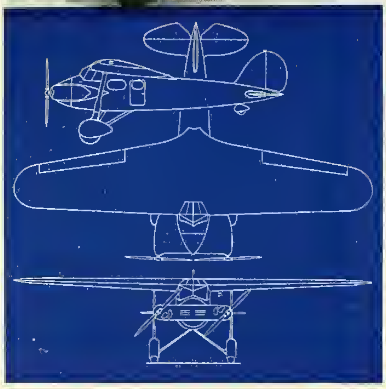
• President: Don P. Smith. Vice-president and Chief Engineer, Gerard F. Vultee.

Nine- or ten-place low-wing monoplane. ATC 545. Wright Cyclone F-2 engine, 735 horsepower at 4000 feet. Span 50 feet. Length overall 37 feet. Height overall 10 feet 2 inches. Wing area 384 square feet. Power loading 11.55 pounds per horsepower. Wing loading 22.1 pounds per square foot. Empty weight 5307 pounds. Useful load 3193 pounds. Gross weight 8500 pounds. Fuel capacity 206 gallons. Oil capacity 15 gallons. Maximum speed 225 miles per hour. Cruising speed 205 miles per hour. Landing speed 63 miles per hour. Service ceiling 20,000 feet. Rate of climb 1000 feet per minute. Cruising range 1000 miles.

Fuselage: true monocoque type, riveted aluminum alloy with transverse framing rings; welded steel demountable engine mount. Wing: aluminum alloy with primary structure of 2 main beams and transverse bulkhead supporting gear; top and bottom surfaces between main beams corrugated sheet with corrugations parallel to span and covered by thin smooth sheet acting with main beams to form torsion resisting box girder; removable wing panels outboard of landing gear bolted to aluminum alloy center section; primary structure of box girder formed by 2 shear spars and top and bottom covering of corrugated sheet with spanwise corrugations overlaid with thin smooth sheet; demountable cantilever leading edge; electrically-operated wing flaps. Retractable landing gear. Tail group: balanced elevators, fabric covered and balanced metal rudder; cantilever fin and stabilizer of aluminum alloy integral with fuselage; stressed skin surfaces of spanwise corrugated sheet covered with thin smooth sheet. Hamilton Standard controllable-pitch propeller. Provision for two-way radio.

Instruments: engine and flight instruments by Kollsman, Pioneer, Weston and Sperry. Also see data in August, 1934, Aero Digest.





ALCOR Duo-6

Alhambra Airport & Air Transport Company, Alhambra, California

• President and Chief Engineer: Allan H. Lockheed. Vice-president, General Manager and Sales Manager: Homer T. Seale. Export representatives: Sverre Krabbe, Oslo, Norway. Companhia Commercial de Representacoes, Ltda., Rio de Janeiro, Brazil, S. A. Tugan, Ltd., Sydney, Australia.

Five- or eight-place high-wing monoplane. Two horizontally disposed Menasco engines, 210 horsepower each. Span 42 feet. Length overall 28 feet 5 inches. Height overall 9 feet 6 inches. Wing area 282 square feet. Power loading 12.1 pounds per horsepower. Wing loading 18.2 pounds per square foot. Empty weight 2885 pounds. Useful load 2205 pounds. Payload 1300 pounds. Gross weight 5090 pounds. Fuel capacity 110 gallons. Oil capacity 10 gallons. Maximum speed 190 miles per hour. Cruising speed 160 miles per hour. Landing speed 57 miles per hour. Service ceiling 18,500 feet. Rate of climb 1400 feet per minute. Cruising range 660 miles.

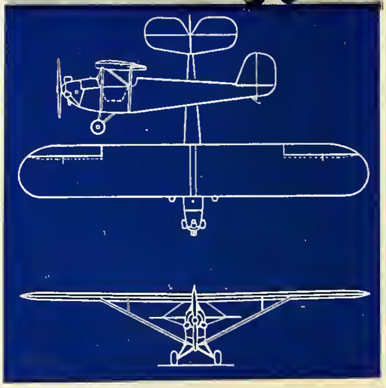
Fuselage: segment-unit, chrome molybdenum frame and laminated wood skin. Wing: cantilever type; modified M-6 wing section; wood structure, box spars and laminated wood skin; ailerons are inset; flaps of laminated wood. Tail group: cantilever type; laminated wood frame, adjustable stabilizer. Fixed divided-type landing gear; two vertical struts extending to front main beam of wing; equipped with 9.50 × 12 Goodyear airwheels, internal expanding hydraulic brakes, hydraulic shock absorbers, streamlined pants.

Standard equipment includes Exide battery, Lycoming-Smith controllable-pitch propeller, non-shatterable glass throughout, heater for cabin. Baggage capacity 40 cubic feet.

Instruments: manifold pressure gauge, oil pressure gauges, oil temperature gauges, tachometers, altimeter, air speed indicator, bank and turn indicator, compass, rate of climb indicator, clock. Also see data in June, 1934, Aero Digest.

AMERICAN Eaglet

The American Eagle-Lincoln Aircraft Corporation, Kansas City, Kansas



• President and Treasurer: Victor Roos. Vice-president: W. B. Williams. Chief Engineer: M. P. Crews.

Two-place open high-wing monoplane. Szekely engine, 45 horsepower. Span 34 feet 4 inches. Length overall 21 feet 7.25 inches. Height overall 8 feet 4 inches. Wing area 164.4 square feet. Power loading 20.5 pounds per horsepower. Wing loading 3.65 pounds per horsepower. Empty weight 509 pounds. Useful load 413 pounds. Gross weight 922 pounds. Fuel capacity 8.5 gallons. Maximum speed 90 miles per hour. Cruising speed 75 miles per hour. Landing speed 25 miles per hour. Service ceiling 14.500 feet. Rate of climb 700 feet per minute. Cruising range 210 miles.

Fuselage: rectangular structure; welded S. A. E. 4130 steel tubes, fabric covered; tandem seating arrangement, with conventional dual controls, main fuel tank behind fireproof bulkhead. Wing: one-piece structure of conventional wood two spar spruce type, fabric covered; spruce compression struts and round tie-rods; attached to fuselage by two sets of cabane Vee struts, with an additional tubing brace extending diagonally from the upper forward fitting to the lower rear fittings on either side; two wing struts extent obliquely down on each side to the lower fuselage longerons; additional bracing provided by two jury struts tying into the wing structure. Tail group: balanced rudder; rigid fin; adjustable stabilizer; streamline wire braced to fuselage longerons. Fixed split-type airwheels on four-inch hubs, Goodrich tires and rubber ring shock absorbers; diagonally braced to provide strength. Cables running over pulleys are used for engine and plane controls.

Standard equipment includes Pyrene fire extinguisher and Flottorp propeller.

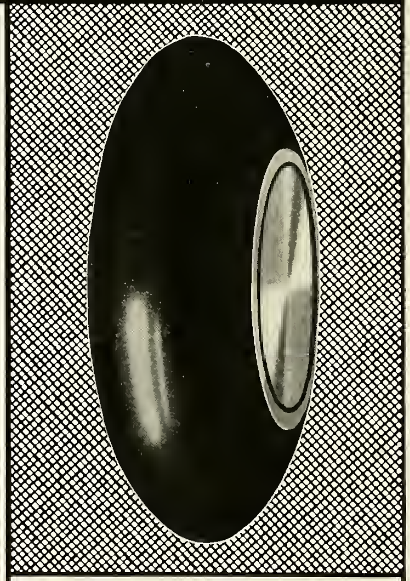
Instruments: altimeter, tachometer, oil pressure gauge, fuel gauge, switch, choke, fuel shut-off. Also see data in September, 1930, Aero Digest.

PENNSYLVANIA AIR LINES ★ ADOPT ★ GENERAL *streamline* TIRES AND WHEELS

● W. S. Rosenberger, Operations Manager of Pennsylvania Airlines states "We have tested General Streamline Tires for hundreds of hours. They have given such remarkable performance and service that we are equipping all of our air transports with this tire."

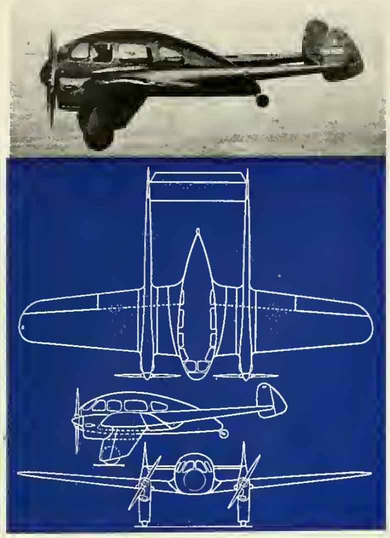
● Pennsylvania Airlines' planes have flown a million miles without a single passenger casualty. Pilots of this line are selected for their experience and outstanding service records. To insure even greater efficiency in maintaining schedules and protecting passengers, Pennsylvania Airlines have adopted the only Streamline airplane tire to accompany the modern plane equipment operated by this line.

For information write to Air Associates Inc.,
Bredouw-Hilliard Aeromotive Service, Inc.,
General Tire & Rubber Company, Akron, Ohio



General Streamline tires reduce parasitic drag of landing gear and wheels ● Have higher performance at take-off ● Greater ease in ground maneuvering and taxying due to wide base construction. ● Reduce ground looping tendencies on landing ● High cushion effect prevents poirpoising.

IF IT'S *streamline* – IT'S A GENERAL



AMERICAN GYRO Crusader

American Gyro Company, Denver, Colorado

• President: F. B. Searle. Vice-president and Chief Engineer: Thomas M. Shelton.

Four- or six-place low-wing monoplane. Two Menasco engines, 150 h.p. at 2260 r.p.m. at 3000 ft. Span 36 ft. Length overall 21 ft. 8 in. Height overall 7 ft. 3 in. Wing area 206 sq. ft. Power loading 9.6 lbs./h.p. Wing loading 14.5 lbs./sq. ft. Empty weight 2000 pounds. Useful load 1000 pounds. Gross weight 3000 pounds. Fuel capacity 50 gallons. Maximum speed 233 miles per hour. Cruising speed 210 miles per hour. Landing speed 55 miles per hour. Service ceiling 24,000 feet. Rate of climb 1760 feet per minute. Cruising range 600 miles.

Fuselage: all-metal flush-type riveted of skin stressed 17 ST duralumin; semi-monocoque construction; streamlined center nacelle faired into wing; entrance door on right side has opening which extends part way up around the top of the fuselage. Wing: all-metal; cantilever type; center section skin stressed 17 ST duralumin construction; two outer wing sections are detachable and of all-metal skin type 17 ST duralumin construction, fabric covered; ailerons are mass-balanced; trailing edge flaps are manually operated and are of fabric covered 17 ST duralumin construction extending from the cabin nacelle to the inner end of the ailerons. Tail group: fabric covered; 17 ST duralumin construction, mass balanced; carried on two rigid, tapered elliptical booms of all-metal semi-monocoque construction which fair into the wing behind each engine nacelle, affording a well for the retracted wheels; twin fins and rudders; single stabilizer and elevator extending between rudders. Landing gear retracts into rear of engine nacelle; hydraulically-operated; equipped with semi-balloon tires, hydraulic brakes, hydraulic shock absorbers.

Standard equipment includes Hamilton Standard variable-pitch or Briner controllable-pitch metal propellers. Also see data in March, 1935, Aero Digest.

ARGONAUT Pirate

Argonaut Aircraft, Incorporated, Tonawanda, New York

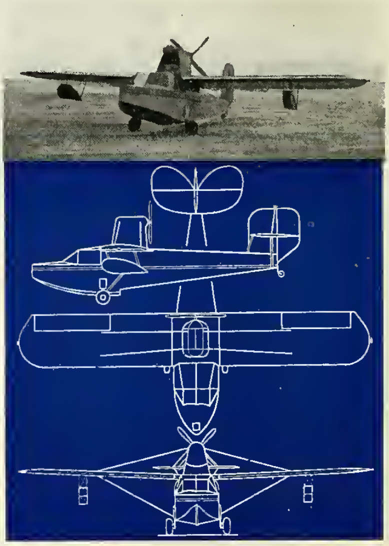
• President: J. Leroy Sutton. Vice-president and General Manager: Howard J. Heindell.

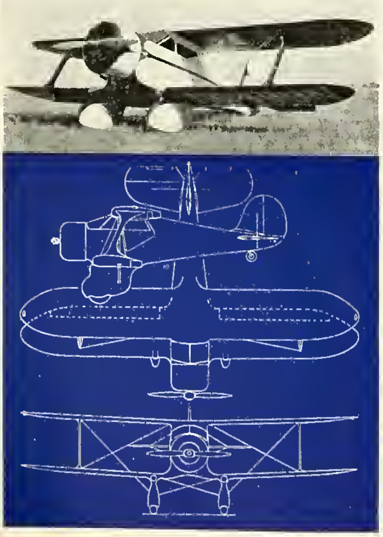
Three-place high-wing pusher-type amphibion. Menasco Pirate C-4 engine, 125 horsepower. Span 35 feet 4 inches. Length overall 26 feet. Height overall 8 feet 2 inches. Wing area 185 square feet. Power loading 15 pounds per horsepower. Wing loading 10.67 pounds per square foot. Empty weight 1100 pounds. Useful load 870 pounds. Payload 100 pounds. Gross weight 1970 pounds. Fuel capacity 40 gallons. Oil capacity 3 gallons. Maximum speed 120 miles per hour. Cruising speed 104 miles per hour. Landing speed 40 miles per hour. Service ceiling 15,000 feet. Rate of climb 1000 feet per minute. Cruising range 500 miles.

Hull: single water step side vent type, semi-monocoque wood construction; Haskelite 7-ply diaphragms connected longitudinally with spruce stringers; Haskelite plywood planked and doped top, bottom; fabric covered. Wing: fabric covered; solid spruce spars; built up ribs; Clark Y section; externally braced with streamline flying and landing wires; nose section plywood covered. Retractable landing gear, positive acting and locking; actuated by wheel in cockpit which moves axle and wheel down by fore-and-aft movement into line of flight; equipped with Goodyear airwheels, mechanical brakes, Rusco ring shock absorbers; full swiveling tail wheel equipped with Goodyear tire; engine mounted on steel tube struts carried through to the landing gear.

Standard equipment includes Flottorp four-bladed metal-tipped wood propeller, starter, cabin heater, anchor, navigation lights, brakes, switch.

Instruments: airspeed indicator, compass, tachometer, fuel gauge, ammeter voltmeter, altimeter, oil pressure gauge, oil temperature gauge, bank and turn indicator.





BEECH 17R Beechcraft

The Beech Aircraft Company, Wichita, Kansas

• President, General Manager, and Sales Manager: Walter H. Beech. Vice-president: R. K. Beech. Chief Engineer: T. A. Wells. Export representatives: Rogers-Jenkins & Co. (Pty.) Ltd., P. O. Box 654, Johannesburg, S. A. Amy Mollison, Grosvenor House, Park Lane, W.I., London England. Maurice Salle, 65 Rue Jacques Dulud Neuilly Sur Seine, Paris, France. J. Angulo, 601 N. Fountain, Wichita, Kansas. Curtiss-Wright Export Corp., R.C.A. Building, New York City, New York.

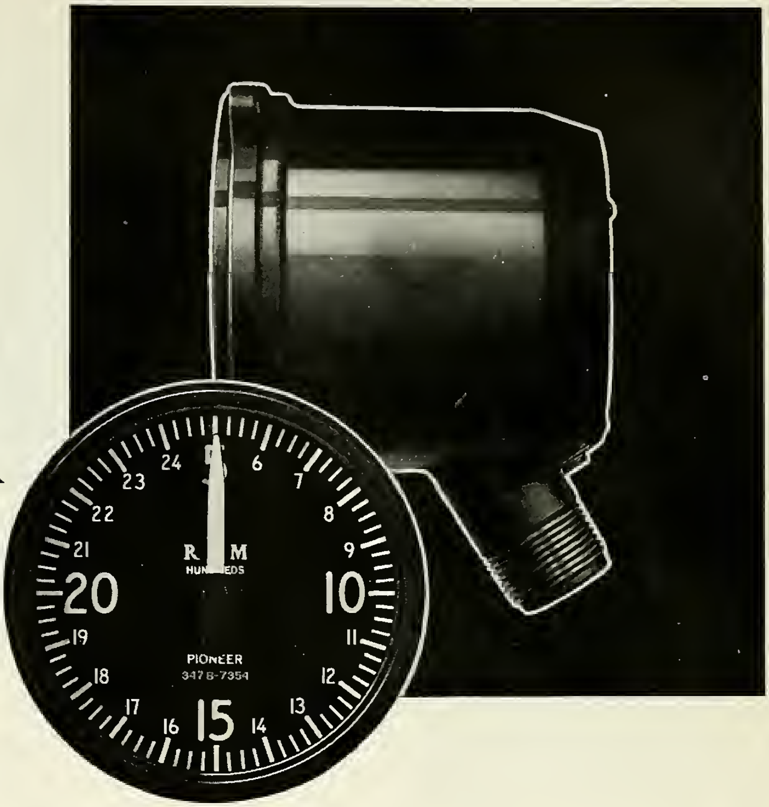
Four-place closed land biplane. ATC 496. Wright Whirlwind R975E engine, 420 horsepower. Span 34 feet 6 inches. Length overall 24 feet 2 inches. Height overall 8 feet 9.5 inches. Wing area 322 square feet. Power loading 10.7 pounds per horsepower. Wing loading 14 pounds per square foot. Empty weight 2700 pounds. Useful load 1800 pounds. Variable payload. Gross weight 4500 pounds. Fuel capacity 145 gallons. Oil capacity 8.5 gallons. Maximum speed 195 miles per hour. Cruising speed 170 miles per hour. Landing speed 55 miles per hour. Service ceiling 17,500 feet. Rate of climb 1750 feet per minute. Cruising range 1000 miles.

Fuselage: framework of steel tubing, welded and covered with fabric and aluminum. Wings: steel tubing spars, spruce ribs, fabric covered. Removable tapered elliptical tips. Inverse stagger type. Flaps in underside of upper wing. Landing gear: semi-retractable type with Goodrich 9.50 × 12 semi-balloon tires, Autofan brakes, pants, and hydraulic shock absorbers. Tail wheel: roller bearing wheel, Goodyear, streamlined.

Standard equipment includes Hamilton Standard metal propeller, radio receiver, electric starter, flaps, brakes, cabin heaters and ventilator, Exide battery, Pyle National navigation and landing lights, electric flares.

Instruments: compass, generator, oil temperature gauge, oil and fuel pressure gauge, tachometer, bank and turn indicator, rate of climb indicator, fuel gauge, air speed indicator, altimeter, ammeter. Also see data in December, 1932, Aero Digest.

TACHOMETER
TYPE 347B



Pioneer Tachometer of the centrifugal type accurately and smoothly indicates the R.P.M. of the engine to which it is attached by means of a flexible shaft. Universally established as the most important instrument of the engine group, the Pioneer Tachometer may be identified on the major portion of airplanes produced within the past ten years ∗ Type 347B retains the original Pioneer design and method of operation. However, many important refinements have been added to increase the efficiency and wearing qualities of this instrument ∗ A new dial with evenly spaced graduations and the new transport pointer, greatly increase the readability of this instrument. ∗ Precision-ground jewels and ball bearings minimize friction and wear, and add to the unusually smooth operation of the actuating mechanism ∗ Carefully selected materials, precision workmanship, rigid vibration and temperature tests...all are combined to assure perfect operation and constantly satisfying service ∗ Pioneer Tachometer 347B embraces in proper balance, all the performance and wear-resisting features for which Pioneer Instruments are famous.

PIONEER INSTRUMENTS

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BEECH B17L Beechcraft

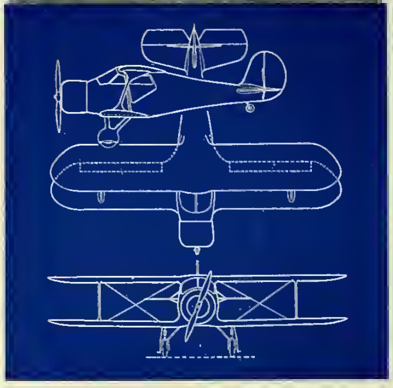
The Beech Aircraft Company, Wichita, Kansas

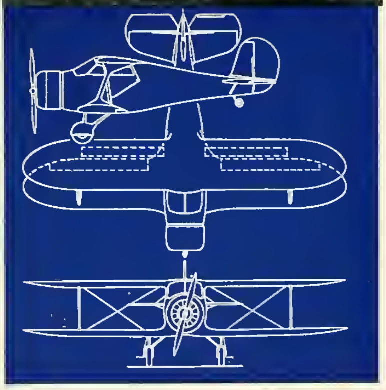
• Four- or five-place biplane. ATC 560. Jacobs L-4 engine, 225 horsepower. Span 32 feet. Length overall 24 feet 5 inches. Height overall 8 feet 6 inches. Wing area 273 square feet. Chord 60 inches. Power loading 14 pounds per horsepower. Wing loading 11.5 pounds per square foot. Empty weight 1800 pounds. Useful load 1350 pounds. Variable payload. Gross weight 3150 pounds. Fuel capacity 50 gallons. Oil capacity 5 gallons. Maximum speed 175 miles per hour. Cruising speed 152 miles per hour. Landing speed 45 miles per hour. Service ceiling 15,000 feet. Rate of climb 1000 feet per minute. Cruising range 550-850 miles.

Fuselage: framework of steel tubing, welded and covered with fabric and aluminum. Wings: inverse stagger type; spars are of spruce, fabricated solid; ribs are also of spruce; built up truss; flaps are built into the underside of each lower wing; the upper wing is attached direct to the top of the fuselage with an I-type heat-treated steel interplane strut on either side of the fuselage; bracing terminals are in the wings and are accessible through inspection covers; elliptical wing tips are outside of the interplane struts. Tail group: wood and welded steel tube framework fabric covered; tab control on elevator. Fully retractable landing gear may be instantly folded inwardly into fuselage; equipped with 24-inch streamlined, or 7.50 × 10 semi-balloon tires, Autofan wheels and brakes, hydraulic shock absorbers; cable controls throughout with movable parts equipped with and operating over ball bearings.

Standard equipment includes starter, generator, navigation lights, Exide battery, sound-proofed cabin, safety-glass windshield, Hartzell wood propeller.

Instruments: compass, altimeter, ammeter, tachometer, air speed indicator, oil temperature indicator, oil pressure gauge, fuel gauges.





BEECH B17E Beechcraft

The Beech Aircraft Company, Wichita, Kansas

• Four- or five-place biplane. Wright R760 E-1 engine, 285 horsepower. Span 32 feet. Length overall 24 feet 5 inches. Height overall 8 feet 6 inches. Wing area 267 square feet. Power loading 12.6 pounds per horsepower. Wing loading 13.5 pounds per square foot. Empty weight 1900 pounds. Useful load 1200 pounds. Variable payload. Gross weight 3600 pounds. Fuel capacity 70-120 gallons. Oil capacity 5-7.5 gallons. Maximum speed 185 miles per hour. Cruising speed 165 miles per hour. Landing speed 55 miles per hour. Service ceiling 18,000 feet. Rate of climb 1200 feet per minute. Cruising range 700-1200 miles.

Fuselage: the framework is of steel tubing, welded and covered with fabric and aluminum; soundproofed; safety glass windshield sloped and curved to conform to streamlining of plane. Wings: inverse stagger type; elliptical dihedral wing tips; the spars are solid spruce; ribs are of spruce, truss type; decelerator flaps are built into the under side of the upper wings. Tail group: welded steel tube framework covered with fabric; tab control on elevator. The fully retractable landing gear may be instantly folded inwardly into the fuselage completing the streamlining on the underside of the fuselage; it is equipped with 24 inch, or 7.50 × 10 semi-balloon tires, Autofan wheels and brakes, hydraulic shock absorbers. Cable controls are used throughout, with all moveable parts on ball bearings.

Standard equipment includes an Exide battery, starter, generator, engine-driven fuel pump, hand wobble pump, flop over or Tee-Type control column (optional), cabin heater, two cabin ventilators, and navigation lights, metal propeller.

Instruments: oil pressure gauge, oil temperature gauge, tachometer, compass, bank and turn indicator, rate of climb indicator, altimeter, air speed indicator, ammeter.

BEECH A17F Beechcraft

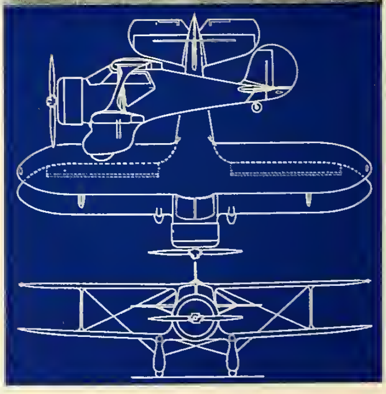
The Beech Aircraft Company, Wichita, Kansas

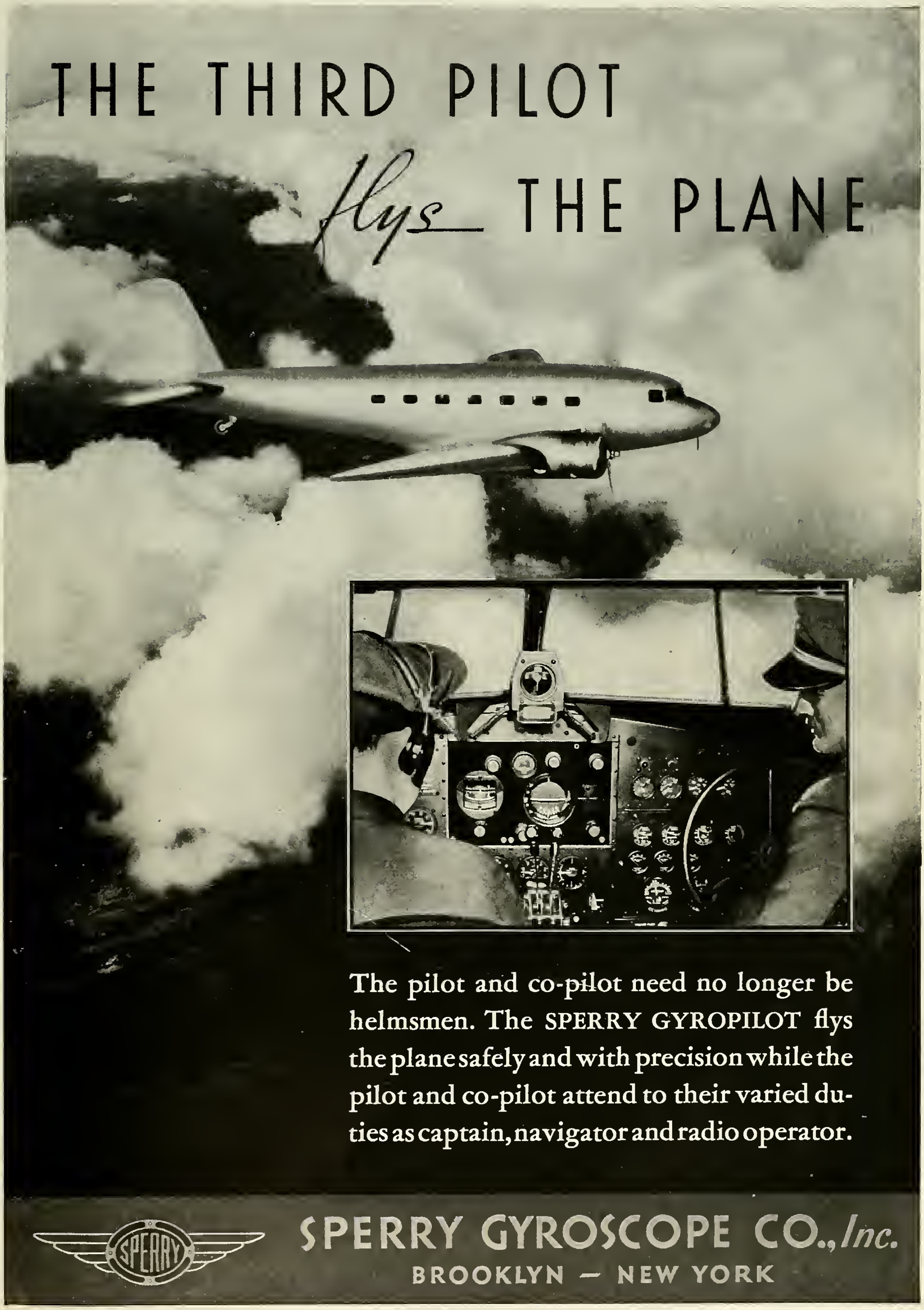
• Four-place biplane. ATC 548. Wright Cyclone R1820-F11 engine, 710 horsepower. Span 34 feet 6 inches. Length overall 24 feet 2 inches. Height overall 8 feet 9.5 inches. Wing area 322 square feet. Chord 60 inches. Power loading 7.5 pounds per horsepower. Wing loading 16.1 pounds per square foot. Empty weight 3285 pounds. Useful load 1915 pounds. Variable payload. Gross weight 5200 pounds. Fuel capacity 155 gallons. Oil capacity 10 gallons. Maximum speed 225 miles per hour. Cruising speed 210 miles per hour. Landing speed 60 miles per hour. Service ceiling 25,000 feet. Rate of climb 2500 feet per minute. Cruising range 750 miles.

Fuselage: framework of steel tubing, welded and covered with fabric and aluminum. Wings are of the inverse stagger type with spars of steel tubing, ribs of spruce; flaps built into underside of upper wing; upper wing attached direct to top of fuselage with one I-type heat-treated steel interplane strut on either side of the fuselage; bracing terminals in wings and accessible through inspection covers. Tail group: welded steel tube framework, fabric covered; adjustable stabilizer. Semi-retractable landing gear with Goodrich 9.50 × 12 semi-balloon tires, Autofan wheels and brakes, pants, and hydraulic shock absorbers. Cable controls are used throughout, with movable parts equipped with and operating over ball bearings.

Standard equipment includes Hamilton Standard controllable-pitch propeller, radio receiver, Pyle National navigation and landing lights which are built directly into the lower wings, electric flares, electric starter, cabin heaters and ventilator, Exide storage battery.

Instruments: compass, generator, air speed indicator, cylinder head, and oil temperature gauges, manifold pressure gauge, oil gauge and fuel pressure gauge, tachometer, bank and turn indicator, rate of climb indicator, fuel gauge, Sperry directional gyro, altimeter, ammeter.





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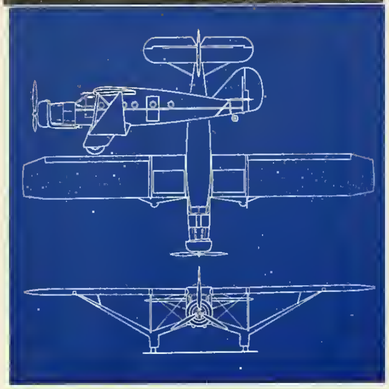


BELLANCA Aircruiser

Bellanca Aircraft Corporation, New Castle, Delaware

• President and General Manager: Giuseppe M. Bellanca. Sales Manager: L. W. Ashton. Chief Engineer: N. F. Vanderlipp. Export representatives: Bellanca Aircraft of Canada, Ltd., Montreal, Canada. Carnasciali & Cia, Ltda., Rio de Janeiro, Brazil. C. K. Turnbull, Buenos Aires, Argentina. M. Galatti, Athens, Greece. Faik Fikri, Ankara, Turkey. Philippine Aerial Taxi Co., Manila, P. I.

Two- or 15-place sesquiplane. Wright Cyclone engine, 715 h.p. Available as cargo plane, land transport, or seaplane. (Specifications given for cargo plane; land transport and seaplane in brackets in that order.) Span 65 ft. Length overall 43 ft. 4 in. Height overall 12 ft. Wing area 654 sq. ft. Chord 94 in. Power loading 16.6 lbs. h.p. Wing loading 16.5 lbs./sq. ft. Empty weight 5731 (5983, 6908) lbs. Useful load 6100 (4870, 4261) lbs. Payload 4925 (5983, 6908) lbs. Gross weight 11,831 (10,853, 11,169) lbs. Fuel capacity 150 (200, 185) gal. Oil capacity 14 (16, 14) gal. Maximum speed 165 (165, 160) m.p.h. Cruising speed 155 (155, 150) m.p.h. Landing speed 65 m.p.h. Service ceiling 20,000 (20,000, 16,000) ft. Rate of climb 700 (700, 750) ft. per min. Cruising range 710 (710, 600) miles.

Fuselage: fabric covered welded steel tubing; spruce fairing strips. Wing: fabric covered; solid spruce spars, routed; stainless steel ribs; auxiliary and stub wing chrome moly steel tubing. Tail group: welded chrome moly steel tubing, except stabilizer which has spruce spars and spot-welded stainless steel ribs; all fabric covered. Cantilever landing gear with 35 × 17 Goodyear airwheels and brakes, oleo shock absorbers, or rudder-equipped floats.

Standard equipment includes Hamilton Standard propeller, Exide battery, bonding and shielding.

Instruments: Sperry gyro-horizon, directional gyro; tachometer, oil pressure, oil temperature gauges, altimeter, compass, air speed, rate of climb, and bank and turn indicators, clock, fuel level gauge.

BELLANCA Senior Skyrocket and Senior Pacemaker

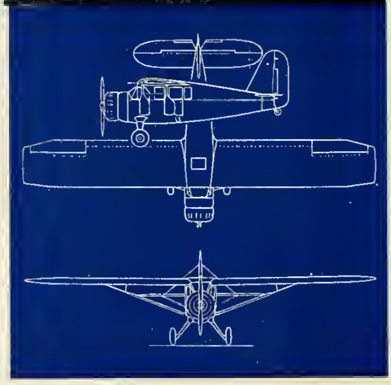
Bellanca Aircraft Corporation, New Castle, Delaware

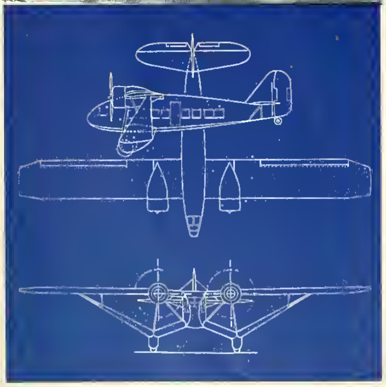
• Six-place high-wing monoplane. (Senior Skyrocket Model 31-50 and Senior Pacemaker Model 31-40 respectively; data on Senior Pacemaker indicated in brackets.) P. & W. Wasp "H" direct-drive engine, 550 horsepower. (Wright Whirlwind R-985-E2 engine, 420 horsepower.) Span 50 ft. 6 in. Length overall 27 ft. 11 in. Height overall 8 ft. 6 in. Wing area 311 sq. ft. Chord 81 in. Power loading 10.2 (12.7) lbs. per h.p. Wing loading 18 (17) lbs. per sq. ft. Empty weight 3150 (3000) lbs. Useful load 2450 (2350) lbs. Payload 1065 (1040) lbs. Gross weight 5600 (5350) lbs. Fuel capacity 200 (175) gal. Oil capacity 14 (12) gal. Maximum speed 190 (165) m.p.h. Cruising speed 175 (155) m.p.h. Landing speed 54 (59) m.p.h. Service ceiling 25,000 (18,000) ft. Rate of climb 1240 (900) ft. per min. Cruising range 910-1290 (1200-1300) miles.

Fuselage: chrome moly steel tubing, welded; fairing strips of spruce; fabric covered. Wing: solid spruce spars, routed; spruce and mahogany plywood ribs; dynamically balanced ailerons; all-metal trailing edge flaps (extra). Tail group: welded moly steel tube, fin, rudder and elevators, fabric covered; wood stabilizer with spruce spars, plywood ribs, fabric covered; trim tab on trailing edge of elevators. Cantilever type landing gear equipped with 31-inch General streamlined tires, Bendix wheels and brakes; oleo shock absorber struts mounted within fuselage belly. Engine and plane controls run over ball bearing pulleys; control bearings of cast aluminum, Alemite fitted. Oil tank is under engine cowl, with an air scoop for cooling the oil adjustable from cockpit.

Standard equipment includes Hamilton Standard propeller, Exide battery, navigation and landing lights, radio compartment.

Instruments: tachometer, oil pressure gauge, altimeter, magnetic compass, air speed indicator, rate of climb indicator, bank and turn indicator, clock, fuel gauges. Also see data in June, 1934, Aero Digest.





BELLANCA Bimotored Transport

Bellanca Aircraft Corporation, New Castle, Delaware

• Eighteen-place sesquiplane. Two Wright Cyclone geared engines, 710 horsepower each. Available as landplane, amphibion, seaplane. (Specifications given for landplane; data on amphibion and seaplane in brackets in that order.) Span 76 feet. Length overall 44 feet. Height overall 14 feet. Wing area 770 square feet. Power loading 10 pounds per horsepower. Wing loading 18 pounds per square foot. Empty weight 8402 (10,700, 10,300) pounds. Useful load 6020 (6120, 6210) pounds. Payload 3700 (3890, 3890) pounds. Gross weight 14,422 (16,910, 16,510) pounds. Fuel capacity 300 gallons. Oil capacity 24 gallons. Maximum speed 190 (180, 180) miles per hour. Cruising speed 170 miles per hour. Landing speed 58 miles per hour. Service ceiling 27,000 (27,000, 22,000) feet. Rate of climb 1500 (1500, 1200) feet per minute. Cruising range 750 (750, 700) miles.

Fuselage: fabric covered; chrome molybdenum steel tubing, welded. Wing: fabric covered; all-metal construction. Tail group: metal structure, fabric covered; twin fins and rudders, the latter being equipped with trim tabs. Partially retractable landing gear on landplane; wheels partly retract into wheel fairing; equipped with 40 × 18 Goodyear tires, Goodyear wheels and brakes, oleo shock absorbers. Rudder equipped floats for seaplane and amphibion are all-metal; the floats are mounted below the junction of auxiliary wing and lower stub wing; junctions between floats and stub wing faired with aluminum alloy cuff.

Standard equipment includes Hamilton Standard metal controllable-pitch propellers, Exide battery, radio wiring, shielding and bonding, Wiley flares, fixed landing lights.

Instruments: tachometer, oil pressure gauge, altimeter, magnetic compass, air speed indicator, rate of climb indicator, bank and turn indicator, fuel gauge, gear position indicator, Sperry gyro-horizon, Sperry directional gyro. Also see data in October, 1934, Aero Digest.

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PROFITABLE, commercial cargo transportation depends almost entirely upon an airplane's payload capacity and operating cost.

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Bellanca Aircraft Corporation

NEW CASTLE • DELAWARE

Bellanca Aircraft of Canada, Ltd., Montreal

Bellanca Cargo Aircruiser

BELLANCA Model 28-70 Racing Monoplane

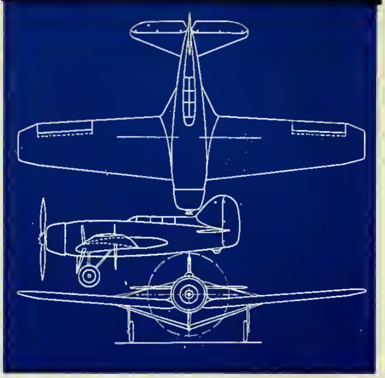
Bellanca Aircraft Corporation, New Castle, Delaware

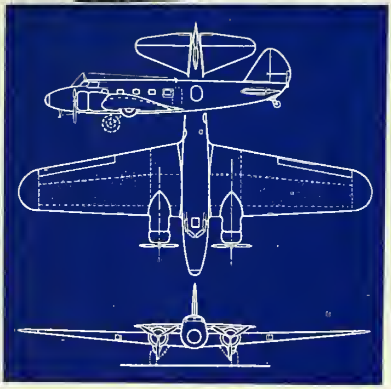
• Two-place low-wing monoplane. P. & W. Twin-row Wasp Junior engine, 750 horsepower. Span 46 feet 1.75 inches. Length overall 25 feet 11 inches. Height 8 feet 8 inches. Wing area 279 square feet. Power loading 11.3 pounds per horsepower. Wing loading 29 pounds per square foot. Empty weight 4076 pounds. Useful load 4284 pounds. Payload 3736 pounds. Gross weight 8350 pounds. Fuel capacity 600 gallons. Oil capacity 40 gallons. Maximum speed 256 miles per hour. Cruising speed 224 miles per hour. Landing speed 82 miles per hour. Service ceiling 26,000 feet. Rate of climb 1540 feet per minute. Cruising range 3085 miles.

Fuselage: chrome molybdenum steel tubing, welded; spruce fairing strips; fabric covered. Wing: spruce spars, plywood ribs, fabric covered; bracing is by streamlined tie rods on the exterior. Tail group: elevators and rudder are of dural structure, fabric covered; stabilizer and fin are wood construction, plywood covered; trim tabs on elevators are adjustable in flight; trim tab on rudder is adjustable on the ground. Fully retractable landing gear, hydraulically-operated; equipped with 32 × 6 Goodrich tires, Bendix wheels and hydraulic brakes, oleo shock absorbers. Engine and plane control pulleys are mounted on ball bearings; others are of cast aluminum, bronze bushed. Two streamlined cabane struts are below the fuselage for attachment of flying wires.

Standard equipment includes navigation and instrument lights, Hamilton Standard controllable-pitch propeller, Exide battery, engine cowl.

Instruments: Sperry gyro-horizon, Sperry directional gyro, tachometer, oil temperature gauge, oil pressure gauge, manifold pressure gauge, altimeters, magnetic compass, air speed indicators, rate of climb indicator, turn and bank indicator, fuel gauges, landing gear retraction indicator. Also see data in October, 1934, Aero Digest.





BOEING 247-D

Boeing Aircraft Company, Seattle, Washington

• President: C. L. Egtvedt. Vice-president in charge of manufacturing: G. W. Carr. Vice-president in charge of sales; Erik H. Nelson. Vice-president and Chief Engineer: C. N. Monteith. Vice-president and Eastern Representative: J. P. Murray.

Twelve-place low-wing monoplane. ATC 558. Two P. & W. S1H1-G geared Wasp engines, 550 horsepower each. Span 74 feet. length overall 51 feet 7 inches. Height overall 12 feet 2 inches. Wing area 836.13 square feet. Power loading 12.4 pounds per horsepower. Wing loading 16.3 pounds per square foot. Empty weight 8940 pounds. Useful load 4710 pounds. Payload 2582 pounds. Gross weight 13,650 pounds. Fuel capacity 273 gallons. Oil capacity 20 gallons. Maximum speed 200 miles per hour. Cruising speed at 8000 feet 180 miles per hour. Cruising speed at 12,000 feet 189 miles per hour. Landing speed 62 miles per hour. Service ceiling 25,400 feet. Rate of climb 1150 feet per minute. Cruising range at 75% horsepower at 8000 feet 745 miles. Cruising range at 62.5% horsepower at 8000 feet 835 miles.

Fuselage: semi-monocoque; duralumin bulkheads, longerons, skin stiffeners and skin covering. Wing: cantilever; spar trusses of square and rectangular aluminum alloy tubing, ribs and smooth metal skin; trailing edge tabs on elevators, rudder and one aileron for trimming plane in flight and for correction of unbalanced propeller thrust. Tail group: cantilever; front and rear spars braced with ribs, all of channel section, smooth skin covered except elevators and rudder which are fabric covered. Fully retractable electrically-operated divided-type landing gear with Goodrich tires, Warner wheels, brakes, Boeing oleo shock absorbers.

Standard equipment includes heating and ventilation systems, bonding and shielding, Sperry gyro horizon, Sperry directional gyro, Hamilton Standard controllable-pitch propellers, Exide battery. Also see data in November, 1934, Aero Digest.

BROWN Special Racing Plane

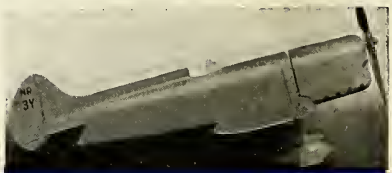
Lawrence W. Brown Aircraft Company, Los Angeles, California

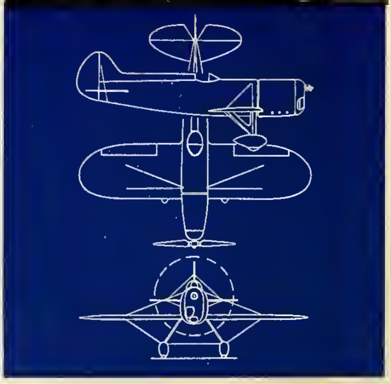
• President and General Manager: Lawrence W. Brown. Vice-president in Charge of Sales: Col. Frank R. McReynolds. Chief Engineer: Daniel E. Holloway.

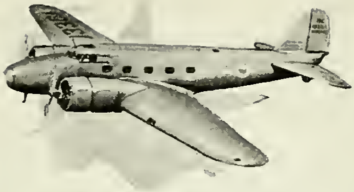
One-place open low-wing monoplane. Menasco C4S engine rated at 150 horsepower. (225 horsepower for racing purposes.) Span 16 feet 8 inches. Length overall 16 feet 9 inches. Power loading 4.82 pounds per horsepower. Wing loading 19.2 pounds per square foot. Empty weight 680 pounds. Useful load 284 pounds. Gross weight 964 pounds. Fuel capacity 20 gallons. Oil capacity 3 gallons. Maximum speed 240 miles per hour. Landing speed 70-80 miles per hour.

Fuselage: fabric covered; welded steel tubing with spruce fairings; semi-enclosed cockpit with small windshield and head rest extending back to the fin; engine mount built integral with fuselage. Wing: fabric covered; spars solid spruce; ribs spruce and basswood; steel tube and wire drag bracing; leading edge reinforced with false ribs and two-ply fabric covering; flaps have solid spruce spars; spruce and basswood ribs. Tail group: fabric covered; steel tubing, wire braced. Fixed-type landing gear equipped with Goodyear airwheels, streamlined wheel pants; consists of two side Vees, the apices of which form the anchorage of the lower wing-bracing wires and interconnected by a single horizontal streamline wire. Fafnir ball bearings for engine and plane controls.

A commercial adaptation of this plane known as the DeLuxe Touring plane will accommodate two persons in tandem cockpits with dual controls and a sliding canopy for both cockpits; flaps will be manually controlled while slots will be of the fully automatic type; complete blind and night flying instruments will be available in the rear cockpit and standard equipment will include landing and navigation lights, wiring for radio installation, electric starter and generator, or battery ignition which will be optional equipment. Also see data in August, 1934, Aero Digest.







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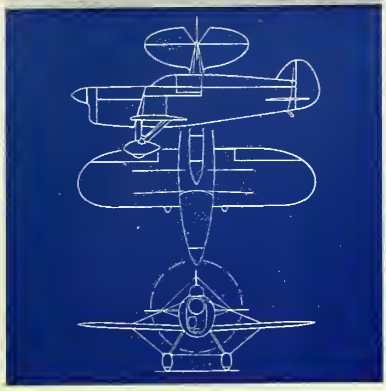


BROWN Miles & Atwood Special

Lawrence W. Brown Aircraft Company, Los Angeles, California

• One-place open low-wing monoplane. Menasco C4S engine, inverted in-line rated at 150 horsepower. (225 horsepower for racing purposes.) Span 16 feet 8 inches. Length overall 16 feet 9 inches. Wing area 50 square feet. Power loading 5.1 pounds per horsepower. Wing loading 20.5 pounds per square foot. Empty weight 741 pounds. Useful load 384 pounds. Gross weight 1025 pounds. Fuel capacity 20 gallons. Oil capacity 3 gallons. Maximum speed 240 miles per hour. Landing speed 70-80 miles per hour.

Fuselage: fabric covered; welded steel tubing with spruce fairing; rigid engine mount integral part of fuselage; small windshield with streamlined head rest extending back to the fin. Wing: fabric covered; spars solid spruce; ribs built up spruce and basswood; Curtiss racing airfoil section with a thin leading edge; steel tube and wire drag bracing; two-ply reinforcing over leading edge of wing; flaps have solid spruce spars, built up spruce and basswood ribs. Tail group: fabric covered; welded steel tubing; wire bracing. Rigid type landing gear equipped with Goodyear airwheels enclosed in streamlined pants; consists of two side Vees, the apieces of which form the anchorage of the lower wing-bracing wires and interconnected by a single horizontal streamlined wire.

Standard equipment includes Hamilton Standard hub and special blades by Story-Gawley.

This plane was first flown in 1933 at the National Air Races and was awarded the American air race championship for its 1934 showing where it was a winner at New Orleans, Miami, Omaha, Buffalo and the Cleveland air races. It also established a new official straightaway speed record for light planes at 233.44 miles an hour and a new 100-kilometer closed course record of more than 209 miles per hour. It is owned and flown by Leland S. Miles.

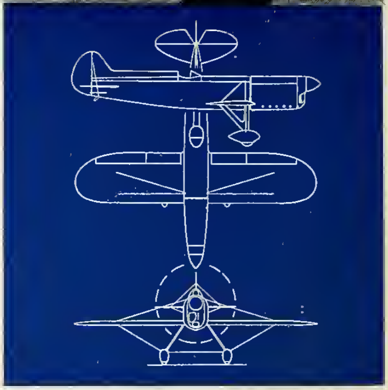
BROWN Special Miss Los Angeles Racing Plane

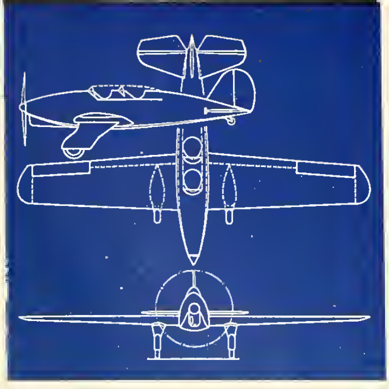
Lawrence W. Brown Aircraft Company, Los Angeles, California

• One-place open low-wing monoplane. Menasco C6S engine, inverted in-line, 300 horsepower at 2800 revolutions per minute for racing purposes. Span 19 feet 3 inches. Length overall 19 feet 10 inches. Wing area 60 square feet. Power loading 4.33 pounds per horsepower. Wing loading 21.65 pounds per square foot. Empty weight 882 pounds. Useful load 417 pounds. Gross weight 1299 pounds. Fuel capacity 30 gallons. Oil capacity 4 gallons. Maximum speed 270 miles per hour. Landing speed 50-60 m.p.h.

Fuselage: fabric covered; welded steel tubing with spruce fairing; semi-enclosed cockpit with small windshield and streamlined head rets running into the fin; oil cooler mounted along belly of plane consisting of three parallel aluminum tubes extending from engine compartment to the rear of the pilot's seat; oil tank mounted behind the pilot. Wing: fabric covered; spars solid spruce; ribs spruce and basswood; steel tube and wire drag bracing; leading edge reinforced with false ribs and two-ply fabric covering; ailerons controlled by torque tubes passing through the torque tubes controlling the flaps; flaps of the full trailing edge type have solid spruce spars and spruce and basswood ribs. Rigid landing gear equipped with Goodyear airwheels which absorb landing shocks; consists of two side Vees, the apieces of which form the anchorage of the lower wing-bracing wires and interconnected by a single streamline wire. Front of fuselage streamlined with bullet-nose spinner which covers the entire propeller hub; the engine is cowled with a smooth venturi slot arrangement which provides cooling with minimum drag. Fafnir bearings on all controls.

Instruments: air speed indicator, tachometer, oil temperature gauge, oil pressure gauge, cylinder head temperature indicator, altimeter. Also see data in August, 1934, Aero Digest.





CAIRNS Model A

Cairns Aircraft Corporation, Naugatuck, Connecticut

• President: Edmund B. Cairns. Vice-president and Treasurer: Harris Whittemore, Jr.

Two-place open or closed low-wing monoplane. Wright Whirlwind engine, 165 horsepower. Standard model takes all Whirlwind type engines; other engines also can be used. Span 36 feet 6 inches. Length overall 24 feet 7.5 inches. Height overall 7 feet 6 inches. Wing area 161 square feet. Power loading 12 pounds per horsepower. Wing loadings 15 pounds per square foot. Empty weight 1500 pounds. Useful load 1000 pounds. Payload 650 pounds. Gross weight 2500 pounds. Fuel capacity 50 gallons. Oil capacity 5 gallons. Maximum speed at 2000 feet at 2000 r.p.m. 190 miles per hour. Cruising speed at 2000 feet at 1600 r.p.m. 160 miles per hour. Landing speed 45 miles per hour. Service ceiling 18,000 feet. Rate of climb 1100 feet per minute. Cruising range 800 miles.

Fuselage: monocoque type; machine-formed dural; smooth surface rivets countersunk; circular triangular cross section; tandem cockpits. Wing: multiple tapered spars of 17ST dural; full cantilever; Alclad covering, smooth skin, screwed on and locked with special lock washers; flaps optional equipment. Tail group: welded steel, coated with Latex and Alclad covered, smooth skin; tapered chrome molybdenum steel tubes with splined ends engaging control levers are main beams of tail group. Landing gear fully retractable, partially retractable or fixed, as desired. Standard model fixed divided type; each unit consists of steel framework incorporating patented system of shock absorption; streamlined fairings of Alclad with wheels equipped with Cairns brakes and Goodyear tires. Ball bearings for engine and plane controls.

Instruments: altimeter, tachometer, oil pressure gauge, oil temperature gauge, cylinder temperature gauge, air speed indicator, fuel gauge, bank and turn indicator. Also see data in January, 1932, Aero Digest.

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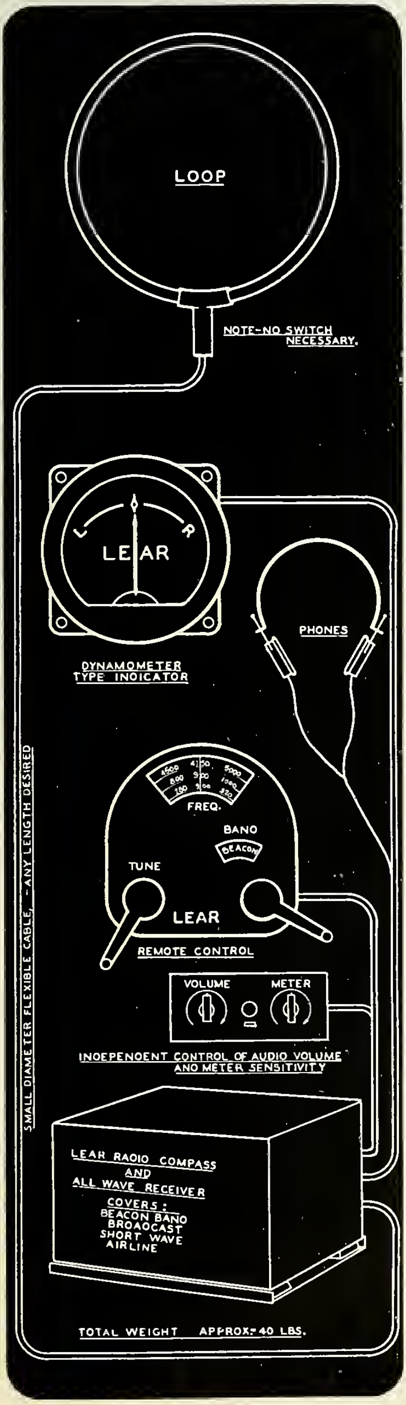
—when you use the new

LEAR RADIO COMPASS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Perfect aural reception from broadcast and beacon stations while using it as a navigating instrument. Perfect compass or 'homing' bearings when listening to weather reports and entertainment broadcasts. Insist on your compass having this necessary feature.

PUBLICITY doesn't make a radio compass, neither does genius. It is just a matter of hard work, careful thought and intelligent application of well known principles.

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Perfection of detail determines utility, accuracy, reliability and ruggedness. Lear engineering insures these qualities; experience proves this fact.

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A N Beam Signal	Right-Left Compass	Airlines, Two Way contacts
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EQUIPMENT

THE Radio Compass installation comprises a stream-lined Loop Aerial (20" in diameter) with necessary mounting brackets; the Receiver-Compass chassis and dynamotor in one cabinet (size 8½" x 10½" x 15"); Remote Tuning Control Unit; Remote Volume and Meter Unit; Visual Indicator Meter and Headphones. Total Weight of all equipment about 40 lbs.

PRICE FOR COMPLETE EQUIPMENT, $800

The Lear Radio Compass is guaranteed to do more, and do it more accurately, than any other design.

WRITE FOR COMPLETE INFORMATION

Lear Developments, Inc.

Aircraft Radio Engineers

125 West 17th Street, New York, N. Y.

CESSNA Model C34

Cessna Aircraft Company, Inc., Wichita, Kansas

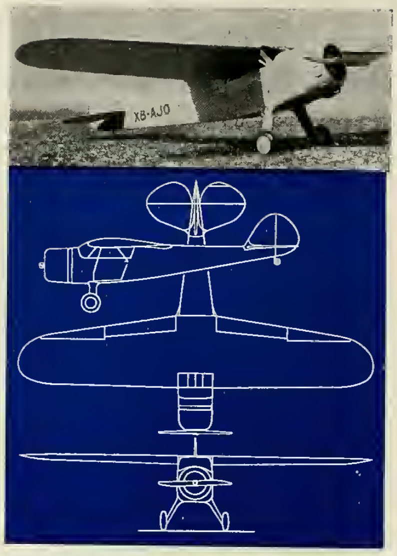
• President: C. V. Cessna. General Manager and Chief Engineer: Dwane L. Wallace. Assistant Chief Engineer: Tom Salter.

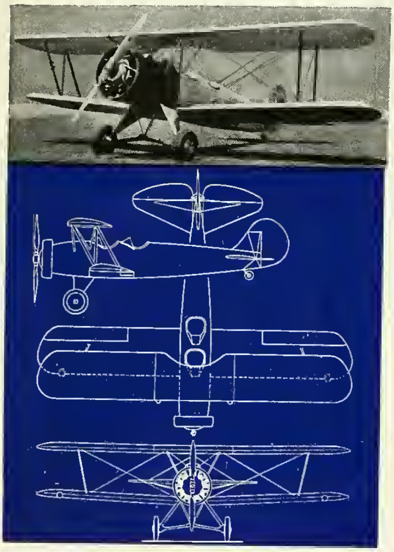
Four-place, high-wing monoplane. Warner Super Scarab engine, 145 horsepower. Span 33 feet 10 inches. Length overall 24 feet 7 inches. Wing area 180 square feet. Power loading 15.17 pounds per horsepower. Wing loading 12.18 pounds per square foot. Empty weight 1220 pounds. Useful load 980 pounds. Gross weight 2200 pounds. Fuel capacity 35 gallons. Oil capacity 3.5 gallons. Maximum speed 162 miles per hour. Cruising speed 143 miles per hour. Service ceiling 18,900 feet. Rate of climb at sea level 1000 feet per minute.

Fuselage: fabric and dural covered; framework of steel tubing, welded; rubber suspension engine mount; control system: dual control; rudder and ailerons cable actuated; elevator push-pull tube; flaps irreversible worm gear; seating arrangement, pilot and one passenger side-by-side in front seat and two passengers side-by-side in rear seat; large doors on either side of the fuselage afford entrance to both front and rear seats. Wing: fabric covered; full cantilever construction tapering in section; solid laminated spars of spruce; spruce ribs; plywood covered leading edge and tips; trailing edge flaps extending from the ailerons to the fuselage; statically balanced Freise-type ailerons mounted directly on rear spar. Tail group: full cantilever; tab control on one elevator. Landing gear: full cantilever equipped with oleo spring shock absorbers, Autofan wheels and brakes, General streamline tires; tail wheel, oleo spring shock absorber, roller bearing, Goodyear streamline tire.

Standard equipment includes Hartzell wood propeller, flaps, cabin ventilators, NACA cowl.

Instruments: compass, fuel gauge, oil pressure gauge, oil temperature gauge, tachometer, air speed indicator, altimeter, bank indicator.





CONSOLIDATED PT-11C

Consolidated Aircraft Corporation, Buffalo, New York

• President: Major Reuben H. Fleet. Vice-president and General Manager: Lawrence D. Bell. Vice-president and Assistant General Manager: Ray P. Whitman.

Two-place open biplane. Wright Whirlwind R760E engine, 240 horsepower. Span 31 feet 6 inches. Length overall 26 feet 9 inches. Height overall 9 feet 4 inches. Wing area 280.5 square feet. Power loading 10.8 pounds per horsepower. Wing loading 9.6 pounds per square foot. Empty weight 1952 pounds. Useful load 748 pounds. Variable payload. Gross weight 2700 pounds. Fuel capacity 41.5 gallons. Oil capacity 4 gallons. Maximum speed 132 miles per hour. Cruising speed 112 miles per hour. Landing speed 50 miles per hour. Service ceiling 16,000 feet. Rate of climb 1060 feet per minute. Cruising range 380 miles.

Fuselage: fabric covered chrome moly welded steel tubing; detachable engine mount; tandem seating arrangement; dual controls; baggage compartment behind rear cockpit; instruments in both cockpits. Wings: heat-treated dural ribs; laminated solid wood spars; fabric covered; fittings heat treated chrome moly steel; taper bolts at all wing hinge and interplane strut connections; wing fitting attachments through Bakelite bushings; N-22 wing section; N-type steel tube center section and interplane struts. Tail group: welded steel, fabric covered; main structural members tubular steel; ribs stamped and tubular sections. Fixed divided-type landing gear equipped with 9.50 × 12 tires, Autofan wheels and brakes, oleo spring shock absorbers; two streamlined side Vees and two half axles hinged at the inner ends to Vee cabane struts beneath the fuselage. All controls ball bearing equipped.

Standard equipment includes Hamilton Standard metal propeller.

Instruments: tachometer, oil pressure gauge, oil temperature gauge, altimeter, clock, compass. Also see data in July, 1931, Aero Digest.

FLEET Models 10 and 11

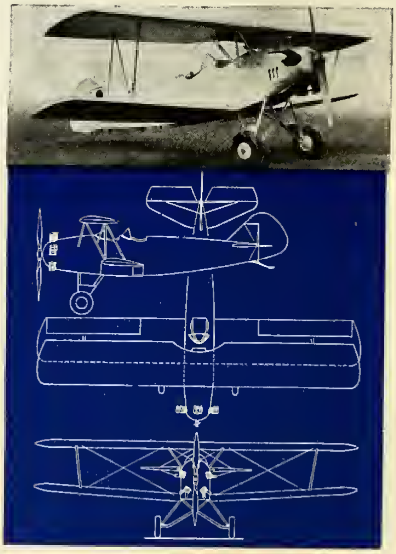
Consolidated Aircraft Corporation, Buffalo, New York

• Two-place open land or seaplane biplane. (Models 10 and 11 respectively; data on Model 11 indicated in brackets.) ATC 374 (526). Kinner B-5 engine, 125 horsepower. (Kinner R-5 engine, 160 horsepower). Span 28 feet. Length overall 21 feet. Height overall 7 feet 10 inches. Wing area 194.4 square feet. Power loading 14.1 (11.1) pounds per horsepower. Wing loading 8.72 (8.7) pounds per square foot. Empty weight 1063 (1175) pounds. Useful load 698 (565) pounds. Variable payload. Gross weight 1761 (1740) pounds. Fuel capacity 24-49 (27-52) gallons. Oil capacity 3 gallons. Maximum speed 115 (124) miles per hour. Cruising speed 96 (109) miles per hour. Landing speed 47 (48) miles per hour. Service ceiling 14,300 (17,800) feet. Rate of climb 862 (1178) feet per minute. Cruising range 627 (553) miles.

Fuselage: fabric covered welded chrome moly steel tubing, hermetically sealed; tandem seating arrangement, dual controls. Wings: fabric covered; spruce spars; heat treated duralumin ribs; chrome moly steel tube compression struts; steel tie rods and stamped chrome moly steel fittings carried above fuselage on chrome moly steel tubing external struts; N-type streamlined struts for interplane bracing; ailerons on lower wings only, of triangulated spruce and plywood structure, fabric covered. Tail group: welded steel, fabric covered; main structural members tubular; ribs are both stamped and tubular sections; stabilizer adjustable in flight; fin adjustable on ground and cambered on one side to counteract engine torque. Landing gear of cabane-divided-axle type equipped with 8.50 × 10 tires, Autofan wheels and brakes, oleo-spring shock absorbers; leaf-spring tail skid. Engine and plane controls bronze bushings; oil soaked wood block for push-pull tubes.

Standard equipment includes Hartzell wood propeller or Curtiss Reed metal propeller, and battery.

Instruments: tachometer, altimeter, oil pressure gauge, oil temperature gauge in both cockpits.



SOLDIERS OF THE SKY A Flight of Consolidated P-30 Two-Seat Military Pursuit Airplanes

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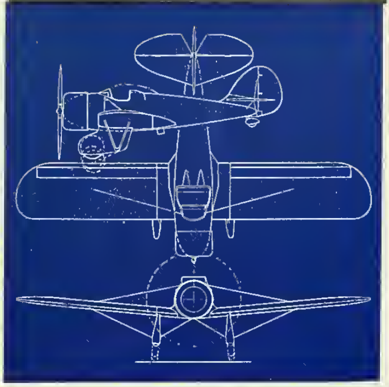
CONSOLIDATED AIRCRAFT CORPORATION, BUFFALO, N. Y.



CUNNINGHAM-HALL Model GA21M

Cunningham-Hall Aircraft Corporation, Rochester, New York

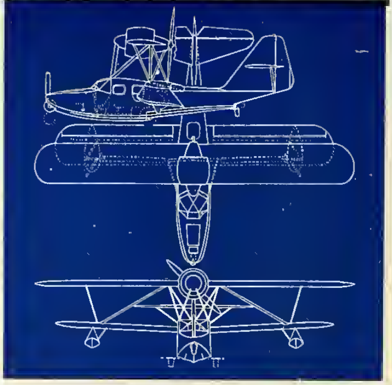
• President: F. E. Cunningham. Vice-president: J. C. Dryer. Sales Manager: W. R. R. Winans. Chief Engineer: R. F. Hall.

Two- or three-place open low-wing monoplane. Warner Super Scarab engine, 145 horsepower. Span 30 feet. Length overall 19 feet 8 inches. Height overall 6 feet 6 inches. Wing area 130 square feet. Power loading 12.8 pounds per horsepower. Wing loading 14.2 pounds per square foot. Empty weight 1300 pounds. Useful load 550 to 750 pounds. Payload from 160 to 360 pounds. Gross weight from 1850 to 2050 pounds. Fuel capacity 32 gallons. Oil capacity 3.75 gallons. Maximum speed 162 miles per hour. Cruising speed 140 miles per hour. Landing speed 40 miles per hour. Service ceiling 17,000 feet. Rate of climb 1300 feet per minute. Cruising range 500 miles.

Fuselage: all-metal; monocoque construction; smooth skin stressed; side-by-side seating arrangement; baggage compartment aft of seats with provision for converting space into room for third person. Wing: fabric and metal covered; all-metal construction; beams heat treated chrome molybdenum tubing; bolted truss type; lateral surfaces mounted in upper rear surface of wing above flaps; flap extends across span of wing and is of all-metal construction; bracing consists of a pair of streamlined wires forward of the cockpit with flying wires doubled and anchored at rear of undercarriage structure. Tail group: fabric covered; metal structure; balanced rudder; adjustable stabilizer. Retractable landing gear equipped with 6.50 × 10 tires, Autofan wheels and brakes, Aerol shock absorbers; retraction is into streamlined chassis fairings. Plane and engine controls are ball-bearing actuated.

Standard equipment includes navigation lights, Hamilton Standard metal propeller, wheel position indicating lights.

Instruments: oil pressure gauge, fuel pressure gauge, oil temperature gauge, tachometer, compass, altimeter, air speed indicator, electric fuel level gauge.



CURTISS-WRIGHT Amphibion CA-1

Curtiss-Wright Airplane Company, Robertson, Missouri

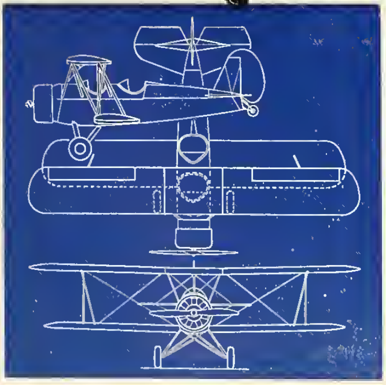
• President: Ralph S. Damon. Vice-president and General Manager: G. J. Brandeweide. Sales Manager: E. K. Campbell. Chief Engineer: George Page. Export representative: Curtiss-Wright Export Corporation, Rockefeller Center, New York City, N. Y.

Five-place biplane pusher-type amphibion. Wright Whirlwind R-975-El engine, 365 horsepower. Span 40 feet. Length overall 31 feet. Height overall 12 feet 2 inches. Wing area 335 square feet. Chord 60 inches. Power loading 12.85 pounds per horsepower. Wing loading 14 pounds per square foot. Empty weight 3100 pounds. Useful load 1600 pounds. Payload 800 pounds. Gross weight 4700 pounds. Fuel capacity 80 gallons. Oil capacity 6.75 gallons. Maximum speed 150 miles per hour. Cruising speed 126 miles per hour. Landing speed 60 miles per hour. Service ceiling 13,000 feet. Rate of climb 850 feet per minute. Cruising range 500 miles.

Hull: anodized and painted Alclad, Alclad covered; cabin arrangement optional with either one pilot or two pilots with dual controls. Wings: fabric covered wood frame construction spruce beams and ribs; NACA 2412 wing section; rigid strut bracing; duralumin ailerons, fabric covered on lower wings only; pronounced stagger permitting greater visibility from cabin; double water rudder connected by springs to main rudder control. Tail group: duralumin construction, protected against corrosion; alclad fin built integral with hull; tabs on elevators controllable from cockpit in flight. Fully retractable landing gear equipped with General streamline tires, Autofan brakes. Wheel in bow of hull retracts into a mast.

Standard equipment includes metal propeller, Exide battery.

Instruments: tachometer, altimeter, oil pressure gauge, oil temperature gauge, air speed indicator. Also see data in August, 1934, and September, 1934, Aero Digest.



CURTISS-WRIGHT Primary Trainer Models 16E and 16WJ

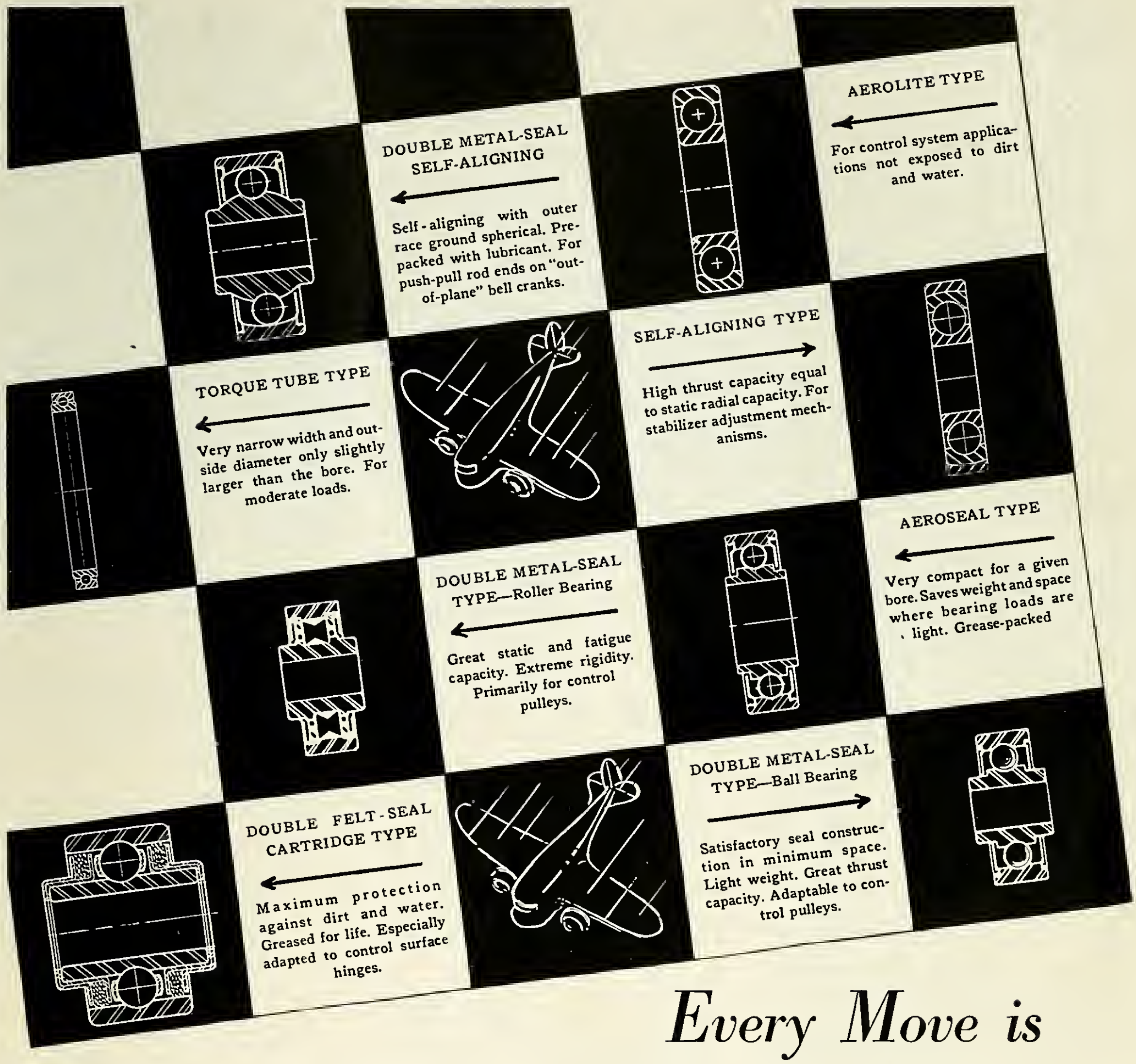
Curtiss-Wright Airplane Company, Robertson, Missouri

• Two-place open biplane. (Models 16E and 16WJ respectively; data on 16WJ indicated in brackets.) Wright Whirlwind R-540-E engine, 175 horsepower (Warner Scarab Junior engine, 90 horsepower). Span 28 feet 10 inches. Length overall 20 feet 9 inches. Height overall 8 feet 10 inches. Wing area 222 square feet. Chord 48 inches. Power loading 11.1 (20) pounds per horsepower. Wing loading 9.5 (8.7) pounds per square foot. Empty weight 1320 (1190) pounds. Useful load 630 (610) pounds. Gross weight 1950 (1800) pounds. Fuel capacity 33 gallons. Oil capacity 4 gallons. Maximum speed 131 (105) miles per hour. Cruising speed 111 (90) miles per hour. Landing speed 47 (45) miles per hour. Service ceiling 17,500 (10,000) feet. Rate of climb 1030 (372) feet per minute. Cruising range 336 (530) miles.

Fuselage: fabric covered; chrome molybdenum steel tubing; treated to prevent rust and corrosion; tandem seating arrangement, dual controls; fittings and attaching brackets for engine mount, wings, undercarriage, empennage and tail wheel welded integral with fuselage. Wings: fabric covered; solid spruce beams, ribs of spruce and mahogany, Warren truss type; leading edges faired with aluminum coated dual sheet; trailing edge formed by rigid Hyblum channel; wire bracing; Clark Y-15 airfoil section. Tail group: fabric covered; steel framework of welded integral units; rudder equipped with overhung balance; stabilizer adjustable in flight; braced by six tie rods, two on either side of fin, one on either side of stabilizer. Fixed split-axle landing gear equipped with Hydro-Flex oleo shock absorbers, low pressure 6.50 × 10 wheels; adaptable for float installation. Plane controls actuated by ball bearing cable controls over pulleys.

Standard equipment includes wood propeller, ignition and engine switches, hand fire extinguisher.

Instruments: tachometer, altimeter, oil pressure gauges. Available in both the front and rear cockpits.



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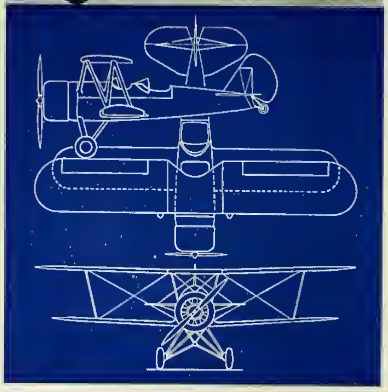
Curtiss-Wright Airplane Company, Robertson, Missouri

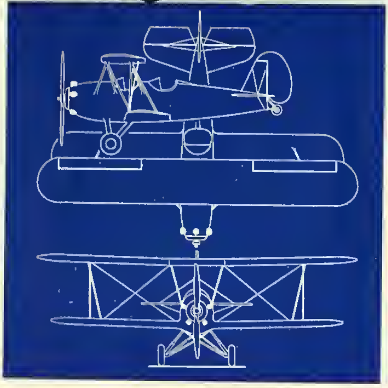
• Two-place open biplane. (Models C-14B9 and C-14-D-T respectively; data on C-14-D-T indicated in brackets). Wright Whirlwind R-975-E engine, 300 horsepower (Wright Whirlwind R-760-ET engine, 225 horsepower). Span 31 feet. Length overall 23 feet 2 inches. Height overall 9 feet 1.5 inches. Wing area 244 square feet. Chord 60 inches. Power loading 8.9 (11.4) pounds per horsepower. Wing loading 12 (11) pounds per square foot. Empty weight 2030 (1930) pounds. Useful load 890 (870) pounds. Gross weight 2920 (2800) pounds. Fuel capacity 66 (79) gallons. Oil capacity 6 gallons. Maximum speed 163 (139) miles per hour. Cruising speed 142 (120) miles per hour. Landing speed 57 miles per hour. Service ceiling 20,000 (14,500) feet. Rate of climb 1350 (860) feet per minute. Cruising range 445 (660) miles.

Fuselage: fabric covered; chrome molybdenum steel tubing, treated to prevent rust and corrosion; tandem seating arrangement, dual controls. Wings: fabric covered; solid spruce beams; ribs built up of spruce webs and cap strips; leading edges faired with aluminum coated dual sheet, trailing edge formed by rigid Hyblum channel; rigid bracing; ailerons are on top wing only. Tail group: fabric covered; steel framework of welded integral units; rudder equipped with overhung balance; stabilizer adjustable in flight. Fixed split axle landing gear equipped with Hydro-flex oleo shock absorbers, low pressure 8.5 × 10 wheels, internal expanding brakes; adaptable for float installation. Plane controls actuated by ball bearing cable controls operating over pulleys.

Standard equipment includes navigation lights, battery, Hamilton Standard metal propeller, switches, fire extinguisher, indirectly lighted instrument board.

Instruments: air speed indicator, tachometer, altimeter, oil temperature gauge, oil pressure gauge, compass, bank and turn indicator, clock, fuel gauge, rate of climb.





CURTISS-WRIGHT Sport Model 16-E

Curtiss-Wright Airplane Company, Robertson, Missouri

• Three-place open biplane. Wright Whirlwind 540-E engine, 175 horsepower. ATC 463. Span 28 feet 10 inches. Length overall 21 feet 1 inch. Height overall 8 feet 10 inches. Wing area 206 square feet. Power loading 12.3 pounds per horsepower. Wing loading 10.4 pounds per square foot. Empty weight 1360 pounds. Useful load 790 pounds. Gross weight 2150 pounds. Fuel capacity 33 gallons. Oil capacity 4 gallons. Maximum speed 135 miles per hour. Cruising speed 115 miles per hour. Landing speed 48 miles per hour. Service ceiling 17,500 feet. Rate of climb 1100 feet per minute. Cruising range 350 miles.

Fuselage: fabric covered; chrome molybdenum welded structure; rigid diagonal bracing; fittings and attaching brackets welded integral with structure; tandem seating arrangement, two side-by-side in front; dual controls and instruments in both cockpits; baggage compartment aft of rear cockpit with door opening on outside of fuselage; detachable engine mount of welded steel tubing. Wings: fabric covered; spars and ribs of spruce; top center section carried above fuselage by steel tube struts; one set of *N*-type interplane struts on either side of fuselage; ailerons on top wing only. Tail group: fabric covered; beams and ribs steel; stabilizer adjustable in flight; fin adjustable on ground; braced by six steel tie rods, two on either side of fin, one on either side of stabilizer. Fixed split-axle type landing gear equipped with air wheels, internally expanding brakes, oleo shock absorbers; top ends anchored to bottom fuselage longerons, bottom ends hinged by half axles to steel tube Vee under fuselage, and by radius rods to centerline of underside of fuselage.

Standard equipment includes Eclipse starter, metal propeller, wiring for navigation lights, front cockpit cover, tail wheel.

Instruments: tachometer, altimeter, oil temperature gauge, oil pressure gauge, Pioneer air speed indicator, compass, fuel gauge.

CURTISS-WRIGHT Speedwing Models A14D, B14B, D14R

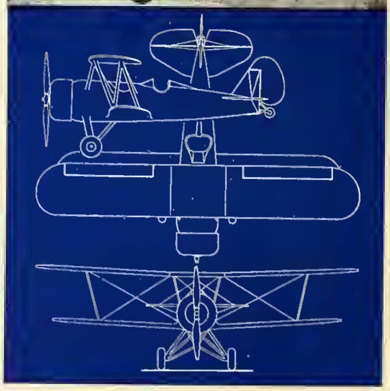
Curtiss-Wright Airplane Company, Robertson, Missouri

• Three-place open biplane. (Models A14D, DeLuxe B14B and Special DeLuxe D14R respectively; data on B14B indicated in brackets and on D14R following brackets in that order). Wright Whirlwind engines, 250 horsepower (330 horsepower) 420 horsepower. ATC 442 (485). Span 31 feet. Length overall 23 feet 6.5 inches. Height overall 9 feet 1.5 inches. Wing area 248 square feet. Power loading 11.5 (9.3) 7.3 pounds per horsepower. Wing loading 11.6 (12.4) 12.4 pounds per square foot. Empty weight 1772 (2008) 2110 pounds. Useful load 1098 (1059) 957 pounds. Gross weight 2870 (3067) 3067 pounds. Fuel capacity 58 (66) 76 gallons. Oil capacity 4.75 (5) 6 gallons. Maximum speed 155 (170) 185 miles per hour. Cruising speed 132 (144) 157 miles per hour. Landing speed 56 (57) 57 miles per hour. Service ceiling 18,000 (20,500) 24,500 feet. Rate of climb 1000 (1300) 1800 feet per minute. Cruising range 550 (550) 500 miles.

Fuselage: fabric covered; welded steel alloy; fittings and attaching brackets welded integral with structure; tandem seating arrangement, two persons in front side-by-side; dual controls. Wings: fabric covered; spars and ribs of spruce; top center section carried above fuselage by steel tube struts; one set of N-type interplane struts on either side of fuselage; ailerons on top wing only. Tail group: fabric covered; rigid steel structure; stabilizer adjustable in flight; fin adjustable on ground. Fixed landing gear equipped with air wheels, internally expanding brakes, oleo shock absorbers; can be adapted for the installation of floats or skis. Plane controls operated by cables on ball bearing pulleys.

Standard equipment includes Curtiss metal propeller, Eclipse starter, and navigation lights.

Instruments: tachometer, altimeter, oil temperature gauge, oil presure gauge, Pioneer air speed indicator, compass, bank and turn indicator, clock, rate of climb indicator, fuel gauge.



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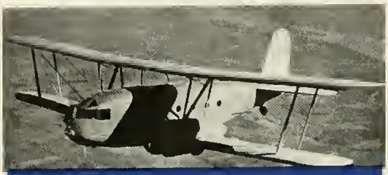
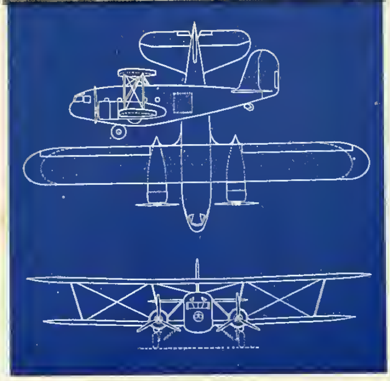




CURTISS-WRIGHT Condor Cargo Carrier CT-32

Curtiss-Wright Airplane Company, Robertson, Missouri

• Two-place biplane. Two Wright Cyclone SGR-1820-F2 geared engines, 750 horsepower each. Span upper wing 82 feet. Span lower wing 74 feet. Length over all 49 feet 7 inches. Height overall 16 feet 7.5 inches. Wing area 1276 square feet. Power loading 12.4 pounds per horsepower. Wing loading 13.9 pounds per square foot. Empty weight 11,762 pounds. Useful load 6738 pounds. Payload 4598 pounds. Gross weight 18,500 pounds. Fuel capacity 350 gallons. Oil capacity 30 gallons. Maximum speed 180 miles per hour. Cruising speed 160 miles per hour. Landing speed 58 miles per hour. Service ceiling 20,000 feet. Rate of climb 1000 feet. Cruising range 750 miles.

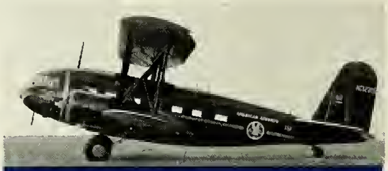
Fuselage: welded 4130 steel tubing, fabric covered; five longerons rigid arch trussed in plane of wing beams and behind and ahead of cabin door; floor structure fabricated from aluminum alloy stringers and arches riveted into sections, arranged either as freight carrier, troop transport, ambulance plane; especially wide loading door. Wings: fabric covered; built up beams, Warren truss type, chrome molybdenum steel tubing; ribs duralumin tubular construction; NACA 2412 airfoil section. Tail group: welded chrome molybdenum steel tubing, fabric covered; ribs of bulb section flanges and round tube diagonal web members. Fully retractable landing gear.

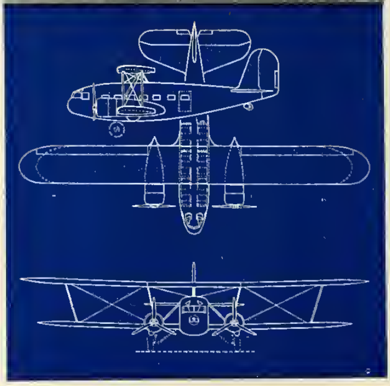
Standard equipment includes Hamilton Standard three-bladed controllable-pitch propellers, Exide battery, monorail hoist, loading ramp, removable rear floor, block and tackle, hold down eyes, two emergency exit doors, hatch in floor for dropping food or supplies, heating and ventilation, radio.

Instruments: Sperry gyro-horizon, Sperry directional gyro, bank and turn indicator, climb indicator, airspeed indicator, standard altimeter, sensitive altimeter, magnetic compass, aircraft clock, main tank fuel gauges, tachometers, oil pressure gauges, manifold pressure gauges, instrument vacuum gauge, fuel pressure gauges. Also see data in February, 1935, Aero Digest.

CURTISS-WRIGHT Condor Day Plane and Sleeplane

Curtiss-Wright Airplane Company, Robertson, Missouri



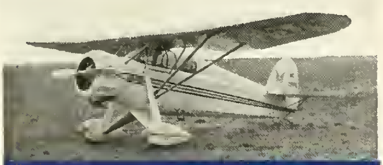


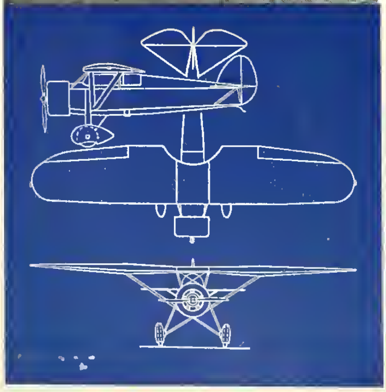
• Fifteen- or nineteen-place biplane. ATC 534. (Models Day Plane T-32 and Sleeplane AT-32 respectively; data on AT-32 indicated in brackets). Two Wright Cyclone SGR-1820-F3 engines 715 h.p. each (Two Wright Cyclone engines, each 710 h.p. at 7000 ft.). Span 82 ft. Length overall 49 ft. 6.375 in. Height overall 16 ft. 4 in. Wing area 1208 sq. ft. Power loading 12.2 lbs./h.p. Wing loading 14.5 lbs./sq. ft. Empty weight 11,465 (12,235) lbs. Useful load 6035 (5265) lbs. Payload 3200 (2600) lbs. Gross weight 17,500 lbs. Fuel capacity 350 gal. Oil capacity 30 gal. Maximum speed at 8000 ft. 190 m.p.h. Cruising speed at 8000 ft. 167 m.p.h. Landing speed 62 m.p.h. Service ceiling 23,000 ft. Rate of climb 1200 ft. per min. Cruising range 650 miles.

Fuselage: fabric covered; welded chrome moly steel tubing; sleeplane has facilities for converting seats into twelve berths. Wings: fabric covered; beams built up Warren truss-type of chrome moly steel tubing; ribs duralumin tubular construction. Tail group: welded chrome moly steel tubing, fabric covered; ribs of bulb section flanges and round tube diagonal web members. Fully retractable landing gear equipped with Bendix wheels and brakes, Cleveland Pneumatic shock absorbers.

Standard equipment includes three-bladed Curtiss electric controllable-pitch propellers, Exide batteries, Lux fire extinguishing system, Pyrene hand extinguisher, landing lights, navigation lights, switches for utility control, instrument lights, navigation lights, fog light, landing lights.

Instrument: Sperry gyro-horizon, Sperry directional gyro, bank and turn indicator, climb indicator, air speed indicator, sensitive altimeter, standard altimeter, compass, clock, tachometers, fuel gauges, oil pressure gauges, instrument vacuum gauge, and other engine and flight instruments. Also see data in February and November, 1933, August, 1934, Aero Digest.





DAVIS Model D1-W

Davis Aircraft Corporation, Richmond, Indiana

• President and General Manager: Walter C. Davis. Vice-president H. G. Davis.

Two-place open or closed high-wing monoplane. Warner Scarab engine, 125 horsepower. Approval 2-394. Span 30 feet 4 inches. Length overall 20 feet. Height overall 7 feet 3 inches. Wing area 144 square feet. Power loading 11.5 pounds per horsepower. Wing loading 10 pounds per square foot. Empty weight 904 pounds. Useful load 557 pounds. Payload 184 pounds. Gross weight 1461 pounds. Fuel capacity 30 gallons. Oil capacity 3 gallons. Maximum speed at 2250 revolutions per minute 142 miles per hour. Cruising speed at 1900 revolutions per minute 123 miles per hour. Landing speed 46 miles per hour. Service ceiling 19,000 feet. Rate of climb 1270 feet per minute. Cruising range 480 miles.

Fuselage: fabric covered; welded SAE 1025 steel tubing; tandem seating arrangement, dual controls; sliding cockpit enclosure with a triangular door providing access to the front cockpit; detachable steel tube engine mount. Wing: fabric covered; spars spruce; ribs dural of rounded channel section; center section carried above wing on steel tube struts; outer sections braced to bottom fuselage longerons by streamlined Vee struts; Gottingen 387 wing section at center, Clark Y at root and tip; unbalanced ailerons hinged to false spars. Tail group: fabric covered; welded steel tube; adjustable stabilizer. Fixed divided type landing gear equipped with 6.50 × 10 tires, Aircraft Products wheels, brakes and shock absorbers; consists of two steel tube oleo legs, the top ends of which are anchored to the top fuselage longerons. Plain engine and plane control bearings.

Standard equipment includes Hamilton Standard metal propeller, wheel pants, bulge-type NACA cowl, navigation lights.

Instruments: tachometer, air speed indicator, altimeter, oil temperature gauge, oil pressure gauge, compass.

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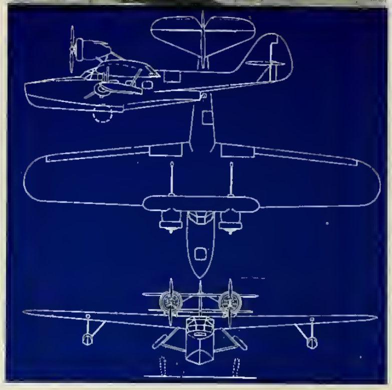
Douglas Aircraft Company, Santa Monica, California

• President: Donald W. Douglas. Vice-president and General Manager: H. H. Wetzel. Vice-president in charge of Sales: C. C. Cover. Vice-president in charge of Engineering: A. E. Raymond. Export representatives: N. V. Nederlandsche Vliegtuigenfabriek, Fokker, Rokin 84, Amsterdam, Holland. E. P. Howard, 51 Canton Road, Shanghai, China.

Eight-place high-wing amphibion monoplane. Approval number 2-479. Two P. & W. Wasp engines, 450 horsepower each. Span 60 feet. Length overall 45 feet 2⅝ inches. Height overall 17 feet 1 inch. Wing area 592 square feet. Power loading 10.6 pounds per horsepower. Wing loading 16 pounds per square foot. Empty weight 6730 pounds. Useful load 2770 pounds. Payload 938 pounds. Gross weight 9500 pounds. Fuel capacity 252 gallons. Oil capacity 20 gallons. Maximum speed 156 miles per hour. Cruising speed 140 miles per hour at 10,500 feet. Landing speed 64 miles per hour. Service ceiling 19,800 feet. Rate of climb 710 feet per minute. Cruising range 720 miles.

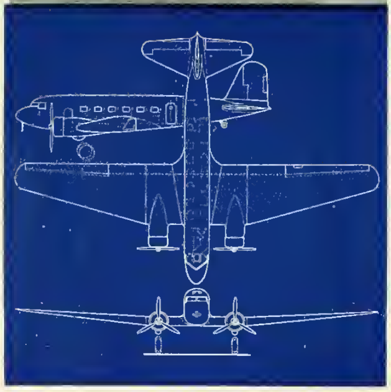
Hull: riveted aluminum alloy with 6 watertight compartments. Wing: full cantilever, box spars of spruce and plywood covering; hydraulically operated flaps in trailing edge of wing outboard of hull on either side; spars, ribs, webs and covering of three-ply mahogany; stringers, battens, blocks and gussets of spruce; trailing edge reinforced with copper strip. Tail group: all-metal stabilizer and fin; rudder and elevators metal frame, fabric covered; trailing edge flaps for balancing trim on elevators. Landing gear: retractable, equipped with 36 × 8 Goodyear tires, Bendix wheels and brakes, and hydraulic shock absorbers. Full swiveling tail wheel. Self lubricating ball bearings for engine and plane controls.

Standard equipment includes Hamilton Standard metal propeller, Exide battery. Optional equipment includes radio, landing lights, and controllable-pitch propeller. Also see data in March, 1931, Aero Digest.



DOUGLAS DC-2

Douglas Aircraft Company, Santa Monica, California



• Sixteen-place low-wing monoplane. ATC 540. Two Wright Cyclone engines, 710 horsepower each. Span 85 feet. Length overall 61 feet 11.75 inches. Height overall 21 feet 1⅛ inches. Wing area 939 square feet. Power loading 12.8 pounds per horsepower. Wing loading 19.4 pounds per square foot. Empty weight 12,010 pounds. Useful load 6190 pounds. Payload 3375 pounds. Gross weight 18,200 pounds. Fuel capacity 510 gallons. Oil capacity 38 gallons. Maximum speed 213 miles per hour. Cruising speed 200 miles per hour at 14,000 feet at 75% power. Landing speed 60 miles per hour. Service ceiling 23,600 feet. Rate of climb 1090 feet per minute. Cruising range 1225 miles at 62.5% power.

Fuselage: semi-monocoque construction, consisting of transverse frames of 24 SO alclad sheet and longitudinal members of 24 ST alclad sheet formed as channels; extruded sections of 17 ST. Covering is of 24 ST alclad sheet. Wing: full cantilever multi-cellular stressed skin construction, consisting of 3 main panels. Spars are of extruded sections of 24 ST with 24 SRT alclad sheet comprising the webs; ribs are pressed from 24 SO alclad sheet and heat treated. Flaps are of the split trailing-edge type extending uninterruptedly from aileron to aileron, hydraulically controlled; construction is of 24 ST sheet and ribs are of 24 SO alclad. Tail group: rudder and elevators metal frame, linen covered; fixed surfaces, all-metal. Fully retractable landing gear; individual units, equipped with Goodrich 15.00 × 16 tires, Bendix wheels and brakes and hydraulic shock absorbers. Self lubricating ball bearings for engine and plane controls. Sperry soundproofing.

Standard equipment includes Exide battery, Consolidated navigation lights and S. & M. landing lights. Complete instrument installation for day and night flying. Automatic pilot optional equipment. Hamilton Standard controllable-pitch propellers.

FAIRCHILD Model 22 C7-D

Fairchild Aircraft Corporation, Hagerstown, Maryland

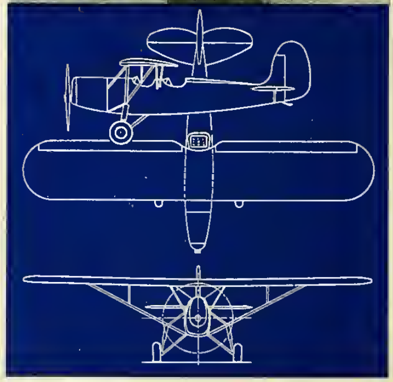
• President: S. M. Fairchild. Vice-president: W. M. Schwebel. Vice-president and General Manager: L. E. Reisner. Sales Manager: H. Eichhammer. Chief Engineers: G. W. Hardman and A. A. Gassner.

Two-place open high-wing monoplane. Wright Gipsy engine, 90 horsepower. ATC 503. Span 32 feet 10 inches. Length overall 21 feet 8 inches. Height overall 7 feet 10 inches. Wing area 170 square feet. Power loading 17.2 pounds per horsepower. Wing loading 9.1 pounds per square foot. Empty weight 993 pounds. Useful load 558 pounds. Payload 244 pounds. Gross weight 1550 pounds. Fuel capacity 21 gallons. Oil capacity 2.4 gallons. Maximum speed 112 miles per hour. Cruising speed 95 miles per hour. Landing speed 48 miles per hour. Service ceiling 13,000 feet. Rate of climb 568 feet per minute. Cruising range 350 miles.

Fuselage: fabric covered; welded steel tubing, truss type; tandem seating arrangement, dual controls. Wing: two-spar type, braced internally with steel tie rods; fabric covered I-section spruce spars; spruce ribs, truss type; braced externally by sloping Vee streamline steel struts to the apices of the two steel tube pyramids on the sides of the fuselage, to which also are attached the legs of the undercarriage; narrow chord ailerons. Tail group: fabric covered; steel tubing; braced externally with streamline struts and wires; adjustable stabilizer. Fixed divided-type landing gear with Goodrich 5.60 × 10 tires, Warner wheels and brakes, oil and spring shock absorbers; consists of two oleo legs, the top ends of which are anchored to the apices of two steel tube pyramids, one on each side of fuselage, with bottom ends hinged to bottom fuselage longerons by steel tube axles and radius rods. Plane and engine controls actuated over ball bearings.

Standard equipment includes Gardner wood propeller.

Instruments: compass, air speed indicator, tachometer, oil temperature gauge, oil pressure gauge, altimeter. Also see data in August, 1933, Aero Digest.



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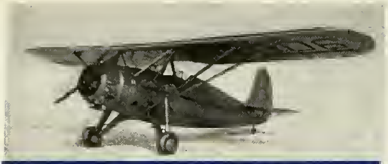
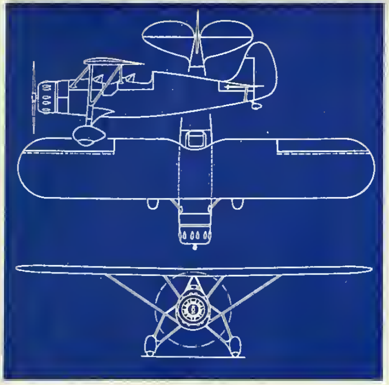




FAIRCHILD Model 22 C7-G

Fairchild Aircraft Corporation, Hagerstown, Maryland

• Two-place open high-wing monoplane. Warner Super Scarab engine, 145 horsepower. Span 33 feet. Length overall 22 feet 3 inches. Height overall 7 feet 11 inches. Wing area 173 square feet. Power loading 14.5 pounds per horsepower. Wing loading 12.4 pounds per square foot. Empty weight 1240 pounds. Useful load 860 pounds. Payload 377 pounds. Gross weight 2100 pounds. Fuel capacity 40 gallons. Oil capacity 3 gallons. Maximum speed 135 miles per hour. Cruising speed 120 miles per hour. Landing speed 48 miles per hour. Service ceiling 16,000 feet. Rate of climb 730 feet per minute. Cruising range 500 miles.

Fuselage: fabric covered; welded steel tubing, truss type; tandem seating arrangement, dual controls; main fuel tank in fuselage; steel tube engine mount. Wing: two-spar type, braced internally with steel tie rods; fabric covered I-section, spruce spars, spruce ribs, truss type; one piece carried above fuselage by splayed out struts and braced externally by sloping Vee streamline steel struts to the apices of the two steel tube pyramids on the sides of the fuselage, to which also are attached the legs of the undercarriage; narrow chord ailerons. Tail group: fabric covered; steel tube; braced externally with streamline struts and wires; adjustable stabilizer. Fixed divided-type landing gear with Goodrich 6.50 × 10 tires, Warner wheels and brakes, oil and spring shock absorbers; consists of two oleo legs, the top ends of which are anchored to the apices of two steel tube pyramids, one on each side of fuselage, with bottom ends hinged to bottom fuselage longerons by steel tube axles and radius rods; equipped with tail wheel enclosed in metal fairing. Plane and engine controls actuated over ball bearings.

Standard equipment includes Hartzell wood propeller, Exide battery, electric starter, navigation lights.

Instruments: compass, altimeter, tachometer, oil temperature gauge, air speed indicator, oil pressure gauge. Also see data in December, 1933, Aero Digest.

FAIRCHILD Models 24 C8-C and C8-D

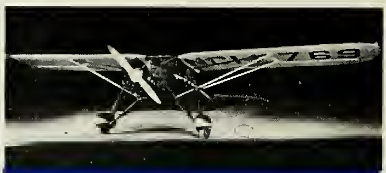
Fairchild Aircraft Corporation, Hagerstown, Maryland

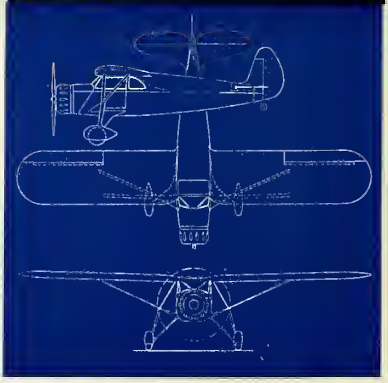
• Three-place high-wing monoplane. (Models C8-C and C8-D respectively; data on C8-D indicated in brackets.) Warner Super Scarab engine, 145 horsepower. (Ranger R-690 engine, 145 horsepower) ATC 535. Span 36 feet 4 inches. Length overall 23 feet 9 inches (24 feet 6 inches). Height overall 7 feet 3 inches. Wing area 186 square feet. Power loading 16.6 pounds per horsepower. Wing loading 12.09 pounds per square foot. Empty weight 1390 (1440) pounds. Useful load 1010 (960) pounds. Payload 577 (527) pounds. Gross weight 2400 pounds. Fuel capacity 40 gallons. Oil capacity 3 gallons. Maximum speed 133 miles per hour. Cruising speed 118 (120) miles per hour. Landing speed 49 miles per hour. Service ceiling 15,500 feet. Rate of climb 700 feet per minute. Cruising range 490 (525) miles.

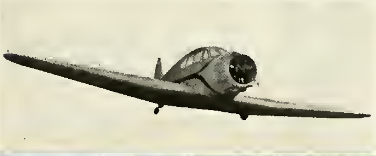
Fuselage: fabric covered; welded steel tubing, truss type; tandem seating arrangement, two seats forward with dual controls; rear seat folds. Wing: fabric covered; I-section spruce spars; truss-type spruce ribs; internal bracing with steel tie rods; wing in two sections each attached to top fuselage longerons and braced to bottom longerons with streamline steel struts which taper in plan and section where they join the fuselage. Tail group: fabric covered; welded steel tubing; braced externally with steel streamline struts and wires; adjustable stabilizer. Fixed divided-type landing gear equipped with Goodrich 6.50 × 10 tires, Warner wheels and brakes, oil and spring shock absorbers. Plane and engine controls are equipped with and operate over, ball bearings. Adaptable for float installation.

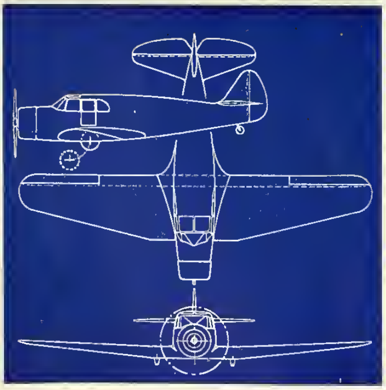
Standard equipment includes electric starter, navigation lights, Exide battery, Hartzell wood propeller.

Instruments: compass, altimeter, tachometer, air speed indicator, oil pressure gauge, oil temperature gauge. Also see data in May, 1934, Aero Digest.









FAIRCHILD Model F-45

Fairchild Aircraft Corporation, Hagerstown, Maryland

• Five-place low-wing monoplane. Jacobs engine, 225 horsepower. Span 39 ft. 6 in. Length overall 28 ft. 11 in. Height overall 8 ft. Wing area 244 sq. ft. Chord 90 in. Power loading 15 lbs./h.p. Wing loading 14.75 lbs./sq. ft. Empty weight 2156 lbs. Useful load 1444 lbs. Payload 880 lbs. Gross weight 3600 lbs. Fuel capacity 60 gals. Oil capacity 4.5 gals. Maximum speed 170 m.p.h. Cruising speed 156 m.p.h. Landing speed 48 m.p.h. Rate of climb 640 ft. per min. Cruising range 600 miles.

Fuselage: fabric covered: welded steel tubing; tandem seating arrangement, three passengers in rear; entrance doors on both sides of ship, one leading to front seats, the other to the rear seats; baggage compartment directly in front of rear seat underneath floor, with access to it by a trap-door arrangement. Wing: fabric covered; center section, extending on both sides of the fuselage and covered with corrugated aluminum alloy, consists of two aluminum alloy beams made up in the form of extrusions fitted with sheet webs and compression members; spars, box section type, spruce, connected to center section beams through aluminum alloy laminations; all-metal ribs, trussed type, flaps extend from aileron to aileron and are manually operated. Tail group: fabric covered; cantilever type; manufactured of aluminum alloy; stabilizer adjustable by tabs. Retractable landing gear mechanically or electrically operated from the cockpit; retraction is through screw and nut arrangement which bends the back supporting strut as the gear is pulled up to the rear; equipped with either Goodyear airwheels, Autofan low pressure or full streamline tires, brakes and oil and spring shock absorbers.

Provision has been made for the installation of landing lights, flares, radio with bonding and shielding, Sperry gyro-horizon, Sperry directional gyro.

Instruments: oil temperature gauge, oil pressure gauge, air speed indicator, altimeter, tachometer, compass, fuel gauges, voltmeter, ammeter, bank and turn indicator.

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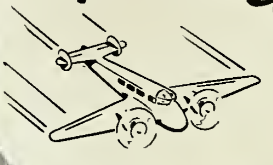

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FAIRCHILD Amphibion XA-942

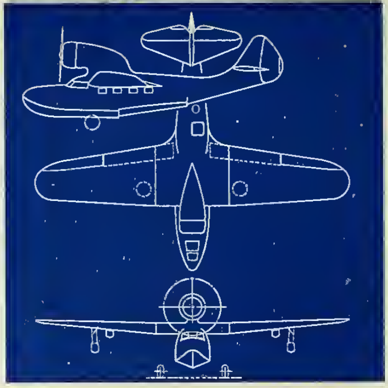
Fairchild Aircraft Corporation, Hagerstown, Maryland

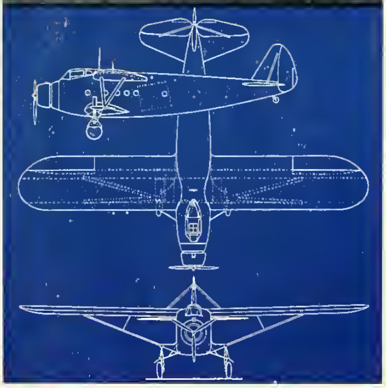
• Ten-place high-wing amphibion. Pratt and Whitney Hornet S3D1 engine, 645 horsepower. Span 57 feet. Length overall 45 feet 9 inches. Height overall 15 feet 11 inches. Wing area 475 square feet. Power loading 13.2 pounds per horsepower. Wing loading 17.9 pounds per square foot. Empty weight 4972 pounds. Useful load 3372 pounds. Payload 1500 pounds. Gross weight 8344 pounds. Fuel capacity 170 gallons. Oil capacity 25 gallons. Maximum speed 186 miles per hour. Cruising speed at sea level 155 miles per hour. Landing speed 63 miles per hour. Service ceiling 18,000 feet. Rate of climb 950 feet per minute. Cruising range 1500 miles.

Hull: all-metal; two-step type; eight seats, four of which are readily removable to provide space for express; plywood floor removable in sections; pilots' compartment forward with side-by-side seating arrangement; passenger entrance in rear on top of after deck. Wing: all-metal, fabric covered; watertight outer panels; detachable wing tips; walkways on top center section to give access to the engine unit; all-metal, fabric covered flaps. Tail group: all-metal fabric covered. Retractable landing gear with provision for substituting skis for wheels. Engine in all-metal low drag cowling above hull and wing; complete unit detachable; nacelle structure of chrome molybdenum steel tubing. Plane controls operated by self-aligning ball bearings; engine controls preformed stainless steel control cables; Zerk fittings and hardened steel bushings used where ball bearings are not provided.

Standard equipment includes Hamilton Standard controllable-pitch propeller, batteries, shielding and bonding, snubbing post fastened to primary structure, anchor, casting line, fire extinguisher. Provision made for installation of Sperry gyropilot.

Instruments: Sperry directional gyro, Sperry gyro-horizon, Pioneer compass, sensitive altimeter, clock, tachometer, oil pressure gauge, fuel pressure gauge, air speed indicator and other flight and engine instruments.





FAIRCHILD XC-31 Cargo Transport

Fairchild Aircraft Corporation, Hagerstown, Maryland

• One-pilot high-wing monoplane. Wright Cyclone R-1820-25 engine, 750 horsepower. Span 84 feet. Length overall 55 feet. Height overall 15 feet 10 inches. Wing area 802 square feet. Power loading 17.4 pounds per horsepower. Wing loading 16.2 pounds per square foot. Empty weight 7322 pounds. Useful load 5678 pounds. Payload 3720-4320 pounds. Gross weight 13,000 pounds. Fuel capacity 200 gallons. Oil capacity 14 gallons. Maximum speed 167 miles per hour. Cruising speed 140 miles per hour. Landing speed 52 miles per hour. Cruising range 750 miles.

Fuselage: fabric covered; welded chrome molybdenum steel tubing; tie rod bracing in most of upper, lower and cross panels; gusset plates, tie rods, lugs and fittings welded to structure are of chrome molybdenum sheet and bar steel; superstructure for pilot's windshield, floor, seat, instrument board support, etc., chrome moly tubing, welded to fuselage; all corrosion proof. Wing: cantilever stub wing chrome moly steel tubing with steel fittings throughout; main wing fabric covered, all-metal; spars of single solid web type with extruded angles as flanges; ribs of channel section cap strips and square aluminum alloy tubular truss members connected by aluminum alloy forgings and rivets; leading edge of metal; Zap-type flaps, all-metal construction; manually or electrically operated. Tail group: fabric covered; all-metal cantilever fin; aluminum alloy rudder with sheet metal nose; trim tab provided at trailing edge of rudder. Retractable landing gear equipped with 40 × 10 tires, hydraulic wheels and brakes. Plane controls operated by cables.

Standard equipment includes three-bladed Hamilton Standard controllable pitch propeller, Pyrene fire extinguisher, M8 airway flares. Plane equipped for transportation of engines, troop transporting, ambulance carrier and passenger carrying; has portable desk, and chute for dropping containers by parachute. Also see data in December, 1934, Aero Digest.

GRANVILLE, MILLER & DE LACKNER Model R6H

Granville, Miller & deLackner, Springfield, Massachusetts

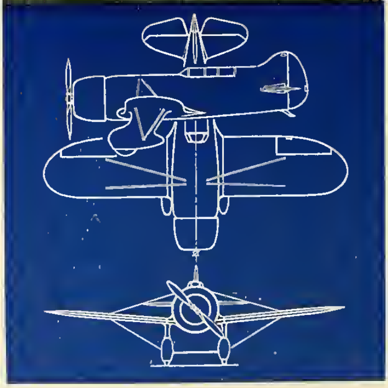
• Howell W. Miller and Donald deLackner, operating in partnership. Chief Pilot: Lee Gehlbach.

Two-place open low-wing monoplane. P. & W. Hornet engine, 675 horsepower. Span 34 feet 3 inches. Length overall 27 feet 3 inches. Height overall 9 feet 3 inches. Wing area 211 square feet. Power loading 10.4 pounds per horsepower. Wing loading 33.2 pounds per square foot. Empty weight 3812 pounds. Useful load 3188 pounds. Gross weight 7000 pounds. Fuel capacity 400 gallons. Oil capacity 20 gallons. Maximum speed at 6000 feet 240 miles per hour. Cruising speed at 6000 feet 200 miles per hour. Landing speed 69 miles per hour. Service ceiling 25,000 feet. Rate of climb 2050 feet per minute. Cruising range 2000 miles.

Fuselage: fabric and aluminum covered; welded chrome molybdenum steel tubing, truss type; tandem seating arrangement with coupe sliding top for each cockpit; detachable engine mount; fuel tanks are slung in the fuselage by padded dural straps. Wing: spars solid spruce; ribs plywood web; plywood covering finished with fabric doped to surface; internally controlled ailerons; double stainless steel streamline braced wires to fuselage; internally controlled double hinged flaps with irreversable self locking control. Tail group: cantilever horizontal and vertical surfaces, skin stressed type, plywood construction; dynamically balanced elevators. Fixed divided-type landing gear equipped with streamline tires, Bendix wheels and brakes, Bendix shock absorbers. Fafnir bearings for plane controls.

Standard equipment includes landing lights, navigation lights, two-way radio, Exide battery, Hamilton Standard controllable-pitch propeller, generator, inertia starter, oxygen equipment, landing and signal flares.

Instruments: Sperry gyro-horizon, turn and bank indicator, sensitive altimeter, air speed indicator, manifold pressure gauge, tachometer, thermocouple, fuel pressure, air temperature and pressure gauges. Also see data in October, 1934, Aero Digest.



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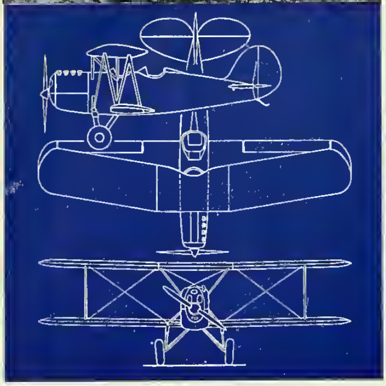


GREAT LAKES 2T-1A

Great Lakes Aircraft Corporation, Cleveland, Ohio

• President and General Manager: Charles F. Barndt. Vice-president and Chief Engineer: P. B. Rogers. Sales Manager: C. L. Johnston.

Two-place open biplane. ATC 228. American Cirrus engine, 100 horsepower. Span 26 feet 8 inches. Length overall 20 feet 4 inches. Height overall 7 feet 11 inches. Wing area 188 square feet. Power loading 15.8 pounds per horsepower. Wing loading 8.43 pounds per square foot. Empty weight 1016 pounds. Useful load 564 pounds. Payload 223 pounds. Gross weight 1580 pounds. Fuel capacity 26 gallons. Oil capacity 2 gallons. Maximum speed 110 miles per hour. Cruising speed 90 miles per hour. Landing speed 40 miles per hour. Service ceiling 9000 feet. Rate of climb 600 feet per minute. Cruising range 370 miles.

Fuselage: welded chrome molybdenum steel tubing; fabric covered; tandem seating arrangement; dual controls with forward controls quickly removable. Wings: routed spruce spars; stamped aluminum alloy ribs; tubular compression members; equal span, staggered; upper wing in three panels with sweepback in outer panels; lower wing in two panels; Frise-type ailerons on lower wing; fabric covered; *N*-type center section and interplane struts. Tail group: aluminum alloy tubular spars; stamped aluminum alloy ribs; fabric covered. Landing gear: split type, equipped with oleo shock absorbers; 24 × 4 wheels on standard model, 22 × 10 airwheels on deLuxe model; leaf spring tail skid is equipped with a detachable manganese shoe.

Standard equipment of the standard model includes a 6 foot-6 inch wood propeller, altimeter, tachometer, oil pressure gauge, oil temperature gauge, fuel gauges; deLuxe equipment includes 6 foot-6 inch metal propeller, air speed indicator, compass, altimeter, tachometer, oil pressure gauge, oil temperature gauge, and upholstered cockpits.

HAMMOND Model Y

Hammond Aircraft Corporation, Ypsilanti, Michigan

• President and General Manager: Dean B. Hammond.

Two-place, side-by-side, low-wing, pusher monoplane, powered with the Menasco B-4 engine, 95 horsepower. Being built for the Bureau of Air Commerce in accordance with specification AB-205. The fuselage will be of all-metal construction with provision made for 40 pounds of baggage and parachute for each passenger. Complete data not available.

The door is close to the ground, facilitating entrance and vision is good in all directions, in all flying attitudes.

Due to the shape of the nose, wind noises will be diminished; engine and propeller noise are back away from the occupants.

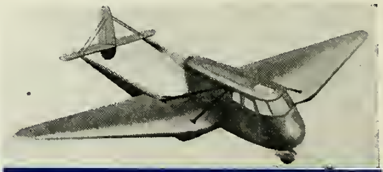
The Model Y has a three-wheel landing gear which prevents nosing over on landing, allows the plane to be landed at the stalling speed, or up to its cruising speed, and eliminates the danger of ground looping. The plane can be landed cross wind and without the use of brakes or rudder will automatically right itself on the ground.

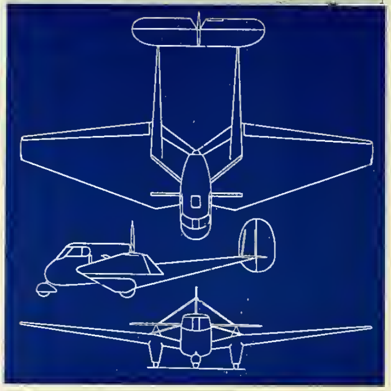
The ship will have a steep glide allowing landings in a small place. Landing speed and rate of descent will be slow and the undercarriage will amply absorb the resulting shock. Landing speed is about 35 miles per hour, and the top speed in excess of 110. Maximum mileage is about 20 miles per gallon.

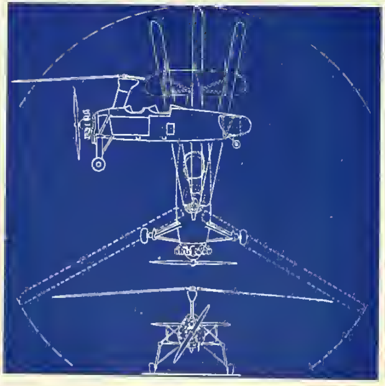
Attention has been given throughout to grease and oil fittings, replaceable bushings, inspection openings, and the general reduction of maintenance costs.

Standard equipment will include a wood propeller, electric starter, storage battery, low pressure tires, brakes, oil shock absorbing struts, housed landing gear, navigation lights, flaps.

Instruments: compass, generator, air speed indicator, tachometer, bank and turn indicator, altimeter, oil temperature gauge, oil pressure gauge, fuel gauge, ammeter, rate of climb indicator.







KELLETT KD-1

Kellett Autogiro Corporation, Philadelphia, Pennsylvania

• President and Sales Manager: W. Wallace Kellett. Vice-president: C. T. Ludington. General Manager: R. G. Kellett. Chief Engineer: R. H. Prewitt.

Two-place wingless direct control autogiro. Jacobs L-4 engine, 225 horsepower. Rotor diameter 40 feet. Length overall (blades folded) 20 feet 6.5 inches. Height overall (blades folded) 10 feet 10 inches. Horizontal tail area 22 square feet. Vertical tail area 12 square feet. Power loading 9.2 pounds per horsepower. Wheel tread 9 feet 6 inches. Empty weight 1375 pounds. Useful load 700 pounds. Payload 220 pounds. Gross weight 2075 pounds. Fuel capacity 49 gallons. Oil capacity 4 gallons. Maximum speed 125 miles per hour. Cruising speed 103 miles per hour. Landing speed nil. Rate of climb 1000 feet per minute. Cruising range 361 miles.

Fuselage: steel tubing throughout with fittings of alloy steel, fabric covered. Rotor system: three blades, alloy steel tubes; inner ends of spars contain hydraulic dampers for controlling blade position about vertical hinge pins; hub machined from alloy steel; strut of chrome molybdenum steel tubing; rotor blades are of the folding type to facilitate storage. Tail group: steel tubing, fabric covered; vertical surfaces give directional stability; small rudder; no elevators. Landing gear of doubled tripod type with axle telescoping into shock strut; equipped with Goodrich 17.5 × 7 tires, 7 × 5 Autofan wheels and brakes, and Cleveland Pneumatic shock absorbers. Torrington and Fafnir ball and needle bearings for engine and plane controls.

Standard equipment includes Heywood compressed air starter and Curtiss Reed metal propeller.

Instruments: Pioneer rotor tachometers, altimeters, air speed indicators, engine tachometer, oil pressure gauge, oil temperature gauge, fuel pressure gauge, fuel gauge, bank and turn indicator, compass.

Also see data in December, 1934, AERO DIGEST.

DEPENDABILITY

Rough-water operations conducted by the U. S. Navy have repeatedly established the ruggedness and dependability of Vought Corsairs. Day in and day out, under grueling conditions, the Corsairs have demonstrated their right to serve with the finest naval aviation service in the world.

CHANCE VOUGHT CORPORATION
EAST HARTFORD, CONNECTICUT

E. E. Wilson, President C. J. McCarthy, Vice-President

SUBSIDIARY OF UNITED AIRCRAFT CORPORATION

KINNER C-7 Envoy

Kinner Airplane & Motor Corporation, Ltd., Glendale, California

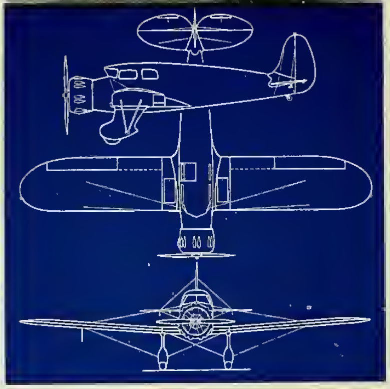
• President and General Manager: Robert Porter. Vice-president: B. L. Graves. Sales Manager: Lillian Porter. Chief Engineer: B. W. James.

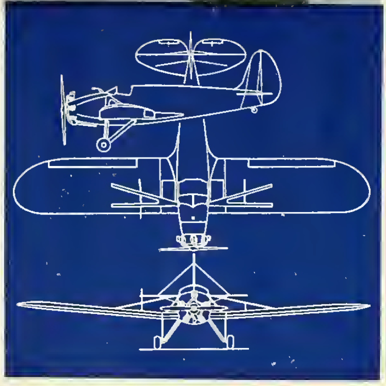
Four-place low-wing monoplane. ATC 532. Kinner C-7 engine, 300 horsepower. Span 39 feet 9 inches. Length overall 28 feet 7 inches. Height overall 8 feet 8 inches. Chord 6 feet. Wing area 229 square feet. Power loading 14.2 pounds per horsepower. Wing loading 18.5 pounds per square foot. Empty weight 2723. Useful load 1527 pounds. Payload 752 pounds. Gross weight 4250 pounds. Fuel capacity 90 gallons. Oil capacity 6 gallons. Maximum speed 165 miles per hour. Cruising speed 150 miles per hour. Landing speed with flaps 55 miles per hour. Service ceiling 17,000 feet. Rate of climb 1000 feet per minute. Cruising range 625 miles.

Fuselage: welded chrome molybdenum steel tubing, fabric and metal covered. Wings: wire braced, spruce spars and ribs, double drag truss, fabric covered; Clark Y airfoil section; electrically-operated flaps, partial span, split trailing edge. Tail group: welded chrome molybdenum steel tube, fabric and metal covered, tabs on elevators rigid stabilizer wire braced to fuselage and to fin. Fixed type landing gear, equipped with 8.50 × 10 Goodrich tires, Autofan wheels and brakes, oleo shock absorbers, has two rigid Vees, from the apices of which a short horizontal fork is hinged forward to take the wheels.

Standard equipment includes shatter-proof glass, Grimes navigation lights, Eclipse electric starter, removable throw-over type dual control wheel, shielding and bonding, parking brake, fire extinguisher, chrome-plated exhaust collector, indirectly lighted instrument panel, radio, generator, and a Hamilton Standard metal variable-pitch propeller.

Instruments: compass, altometer, tachometer, ammeter, airspeed indicator, oil temperature and pressure gauges, rate of climb indicator, bank and turn indicator.





KINNER Sportster Model B and K

Kinner Airplane & Motor Corporation, Ltd., Glendale, California

• Two-place open low-wing monoplane. (Models B and K respectively; data on B indicated in brackets.) ATC 490 (516). Kinner K-5 engine 100 horsepower (Kinner B-5 engine, 125 horsepower). Span 39 feet. Length overall 24 feet 2 inches. Height overall 7 feet. Chord 6 feet. Wing area 227 square feet. Power loading 18.75 (15) pounds per horsepower. Wing loading 8.25 pounds per square foot. Empty weight 1218 (1232) pounds. Useful load 657 (643) pounds. Payload 326 (244) pounds. Gross weight 1875 pounds. Fuel capacity 24 (35) gallons. Oil capacity 2.25 (2.50) gallons. Maximum speed 104 (112) miles per hour. Cruising speed 90 (100) miles per hour. Landing speed 40 miles per hour. Service ceiling 14,000 (15,000) feet. Rate of climb 800 (900) feet per minute. Cruising range 340 (400) miles.

Fuselage: welded chrome molybdenum steel tubing, rectangular structure, fabric covered; side-by-side seating arrangement; dual controls; optional cockpit enclosure. Wings: spruce spars and ribs, double drag truss, fabric covered; Clark Y airfoil section; wings are attached to short stubs built integral with the fuselage and braced to the top fuselage longerons by inverted Vee struts. Tail group: welded chrome molybdenum steel tubing, fabric covered, tabs on elevators; adjustable stabilizer. Fixed type landing gear equipped with Goodyear airwheels 19 × 9 × 3, Goodyear brakes, spring type shock absorbers.

Standard equipment includes Hotspot battery, navigation lights, Eclipse air starter, removable dual controls, parking brake, fire extinguisher, chrome plated exhaust collector ring and tail pipe, baggage compartment, wood propeller.

Instruments: tachometer, altimeter, compass, air speed indicator, oil pressure gauge, oil temperature gauge, fuel gauge, switch.

KINNER R Playboy

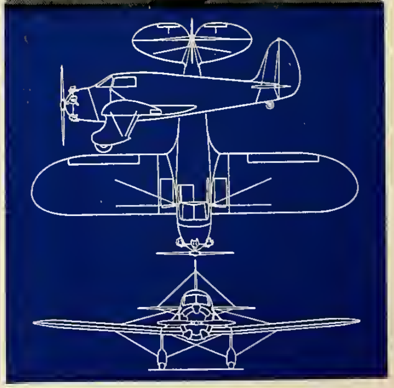
Kinner Airplane & Motor Corporation, Ltd., Glendale, California

• Two-place low-wing monoplane. ATC 554. Kinner R-5 engine, 160 horsepower. Span 32 feet 9 inches. Length overall 24 feet 3 inches. Height overall 7 feet 9 inches. Chord 6 feet. Wing area 189 square feet. Power loading 14.2 pounds per horsepower. Wing loading 12.0 pounds per square foot. Empty weight 1461 pounds. Useful load 809 pounds. Payload 325 pounds. Gross weight 2270 pounds. Fuel capacity 48 gallons. Oil capacity 3.5 gallons. Maximum speed 140 miles per hour. Cruising speed 127 miles per hour. Landing speed 55 miles per hour. Service ceiling 14,000 feet. Rate of climb 800 feet per minute. Cruising range 500 miles.

Fuselage: welded chrome molybdenum steel tubing, fabric and dural covered; side-by-side seating arrangement. Wings: wire braced, spruce spars and ribs, double drag truss, fabric covered; Clark Y airfoil section. Tail group: welded chrome molybdenum steel tubing, fabric covered, tabs on elevator; rigid stabilizer. Fixed type landing gear equipped with 6.50 × 10 Goodyear tires, Autofan wheels and brakes, Kinner oleo shock absorbers; two rigid Vees, from the apices of which a short horizontal fork is hinged forward to take the wheels; shock absorber legs extend to tops of front legs of fixed Vees; each unit enclosed in streamline fairing. Conventional bearings for engine and plane controls.

Standard equipment includes 6-volt battery, shatter-proof glass, indirectly lighted instrument panel, navigation lights, Eclipse air starter, removable dual controls, adjustable seat, radio shielding and bonding, parking brake, fire extinguisher, chrome plated exhaust collector, Hamilton Standard metal variable-pitch propeller.

Instruments: compass, ammeter, oil temperature gauge, oil pressure gauge, clock, air speed indicator, bank and turn indicator, tachometer, rate of climb indicator, fuel gauge.



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THREE KINNER ENVOYS

for

TRANSPORTATION OF PERSONNEL

The ENVOY is a superb four-place cabin airplane . . . equipped with the 300 h.p. KINNER engine . . . at 1750 r.p.m. it cruises 150 m.p.h.
(Guaranteed)

Ample payload permits such extras as controllable pitch propeller, parachutes, etc., *without* eliminating a passenger. Standard equipment includes steel propeller, engine-driven generator, electric starter, radio, electrically operated flaps, ninety gallons gas capacity.

NOT BUILT TO SELL AT A PRICE . . . the construction of the ENVOY meets the approval of the U. S. Navy

Manufactured by

KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
GLENDALE CALIFORNIA

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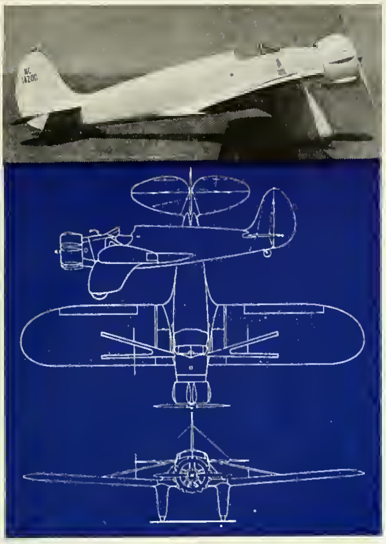


KINNER B-2 Sportwing

Kinner Airplane & Motor Corporation, Ltd., Glendale, California

• Two-place open low-wing monoplane. ATC 522. Kinner B-5 engine, 125 horsepower. Span 34 feet 5 inches. Length overall 24 feet 2 inches. Height overall 7 feet. Chord 6 feet. Wing area 199 square feet. Power loading 16.0 pounds per horsepower. Wing loading 10.0 pounds per square foot. Empty weight 1333 pounds. Useful load 667 pounds. Payload 268 pounds. Gross weight 1950 pounds. Fuel capacity 35 gallons. Oil capacity 2.5 gallons. Maximum speed 122 miles per hour. Cruising speed 110 miles per hour. Landing speed 45 miles per hour. Service ceiling 14,500 feet. Rate of climb 800 feet per minute. Cruising range 440 miles.

Fuselage: welded chrome molybdenum, steel tubing, rectangular structure, fabric covered; side-by-side seating arrangement. Wing: spruce spars and ribs, double drag truss, fabric covered; Clark Y airfoil section; wings are attached to short stubs built integral with the fuselage and braced to the top fuselage longerons by inverted Vee struts. Tail group: monoplane type, welded chrome molybdenum steel tube, fabric covered, tabs on elevators; adjustable stabilizer. Fixed type landing gear, enclosed in streamlined fairings; equipped with Goodyear 6.50 × 10 semi airwheels, Autofan wheels and brakes, and oleo type shock absorbers; swivelling tail wheel with 8 × 3 streamline tire. Conventional bearings for engine and plane controls.

Standard equipment includes a Hotspot battery, navigation lights, Eclipse air starter, removable dual controls, shatter-proof glass windshield, shielding and bonding, parking brake, fire extinguisher, chrome plated exhaust collector, baggage compartment, wood propeller.

Instruments: tachometer, altimeter, air speed indicator, compass, oil pressure gauge, oil temperature gauge.

LAIRD Model LC-1B285

E. M. Laird Airplane Company, Chicago, Illinois

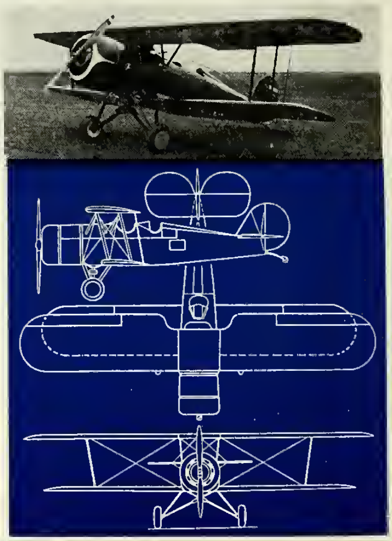
• President and General Manager: E. M. Laird. Vice-president and Sales Manager: H. L. Packer. Chief Engineer: R. L. Heinrich.

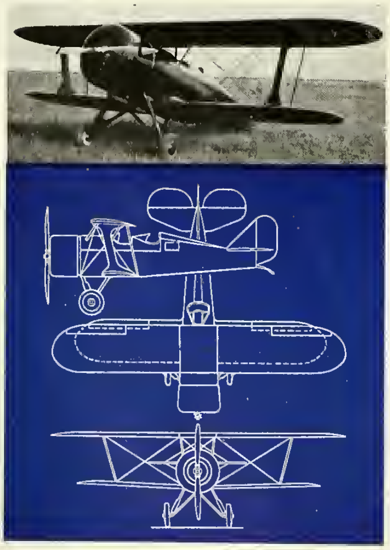
Three-place open biplane. Wright Whirlwind J-6, R-760E-1 engine, 285 h.p. Span 34 feet. Length overall 24 ft. 7 in. Height overall 9 ft. 3 in. Wing area 295 sq. ft. Power loading 10.6 pounds per h.p. Wing loading 10.2 pounds per sq. ft. Empty weight 1927 pounds. Useful load 1108 pounds. Payload 390 pounds. Gross weight 3035 pounds. Fuel capacity 85 gallons. Oil capacity 7 gallons. Maximum speed 150 m.p.h. Cruising speed 135 m.p.h. Landing speed 45 m.p.h. Service ceiling 20,000 ft. Rate of climb 1500 feet per minute. Cruising range 600 miles.

Fuselage: fabric covered; duralumin tubing and tie rods; tandem seating arrangement; two large baggage compartments directly in rear of pilot's seat. Wings: fabric covered; solid spruce spars; ribs of three-ply plywood, reinforced with spruce struts and spruce capping strips; solid spruce compression struts and rigid drag bracing; ailerons independently controlled by push and pull tube system. Tail group: fabric covered; spruce spars and ribs; elevators, rudder and fin welded steel tubing; sheet; stabilizer adjustable from cockpit by vernier type hand controlled unit with indicator. Fixed type landing gear of wide tread and General streamlined tires; Bendix wheels and brakes. Brakes operated by Laird rudder brake pedals in which rudder and brake pedal are a single unit.

Standard equipment includes Hamilton Standard fixed pitch metal propeller, Exide battery, navigation lights, RCA radio, direct electric starter, rear cockpit heater, dual controls, double slot NACA engine cowling.

Instruments: compass, air speed indicator, tachometer, turn and bank indicator, climb indicator, engine head temperature gauge, altimeter, oil pressure gauge, oil temperature gauge and ice warning indicator.





LAIRD Speedwing LC-R300

E. M. Laird Airplane Company, Chicago, Illinois

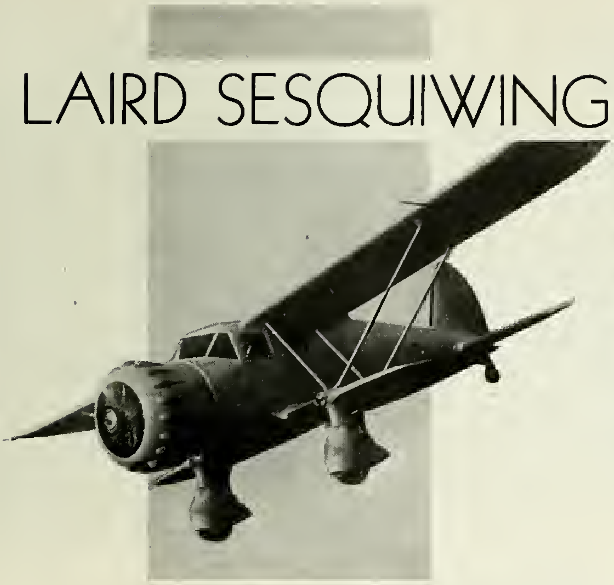
• Three-place open biplane. Wright Whirlwind J-6 R-975E engine, 330 horsepower. ATC 176. Span 28 feet. Length overall 22 feet 9 inches. Height overall 9 feet. Wing area 202 square feet. Power loading 10.3 pounds per horsepower. Wing loading 15.3 pounds per square foot. Empty weight 1922 pounds. Useful load 1088 pounds. Payload 390 pounds. Gross weight 3010 pounds. Fuel capacity 76 gallons. Oil capacity 8 gallons. Maximum speed 175 miles per hour. Cruising speed 135 miles per hour. Landing speed 55 miles per hour. Service ceiling 20,000 feet. Rate of climb 1500 feet per minute. Cruising range 550 miles.

Fuselage: duralumin tubing trussed with tie rods; forward section metal covered to rear of pilot's cockpit, remainder fabric covered; tandem seating arrangement; two large baggage compartments directly in rear of pilot's seat. Wings: fabric covered; solid spruce spars; ribs of three-ply plywood, reinforced with spruce struts and spruce cap strips; solid spruce compression struts and tie rod drag bracing; interplane struts are solid plywood streamline I struts; ailerons are independently controlled by push and pull tube system. Tail group: stabilizer, elevators, rudder and fin are welded steel sheet and tubing, fabric covered; stabilizer adjustable from the cockpit with vernier type control and indicator. Split axle type landing gear of wide tread, with oleo shock absorbers, General streamline tires, Bendix wheels and brakes; brakes operated by Laird rudder-brake pedals, in which rudder and brake pedal are a single unit.

Standard equipment includes a Hamilton Standard variable-pitch propeller, Exide battery, navigation lights, electric starter, dual controls. A Pratt & Whitney Wasp Junior, 300 horsepower engine can be substituted in the Speedwing, in which case the plane is known as the Model LC-RW300.

Instruments: compass, air speed indicator, tachometer, turn and bank indicator, engine head temperature gauge, altimeter, oil pressure gauge, oil temperature gauge.

LAIRD SESQUIWING



Truly a real companion ship to the time-proven LAIRD Speedwing

INCORPORATING the speed qualities of its famed predecessors with the latest developments in cabin comfort, operating safety devices, pay load capacity, etc.—the new LAIRD SESQUIWING brings to the private owner a plane of ideal accommodations and performance.

Cruises 175 with six people, baggage and fuel for five hours' flying; will do 200, full throttle; lands with flaps at 60.

All-metal, semi-monocoque fuselage; P & W or Wright power; electric starter, controllable propeller, radio receiver, Sperry horizon and directional gyro, landing lights and cabin heater—these represent but partially the standard equipment of this newest LAIRD product.

Likewise, the LAIRD SESQUIWING is a desirable plane for feeder line transport service.

THE LAIRD SPEEDWING

One of the snappiest—in performance and style—open cockpit planes in the air. Three-place. Powered with 300 h.p. Wright engine (or P & W Junior), 175 m.p.h. top, 135 m.p.h. cruising; 55 m.p.h. landing. Cruising range 550 miles. Equipment includes brakes, variable-pitch prop, navigation lights, compass.

Complete details will be sent promptly to logical inquirers

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5301 West 65th Street, Chicago, Illinois

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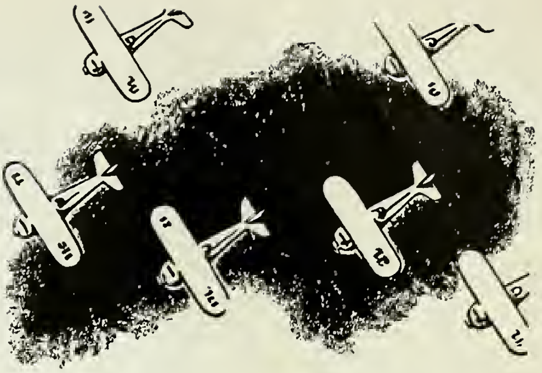

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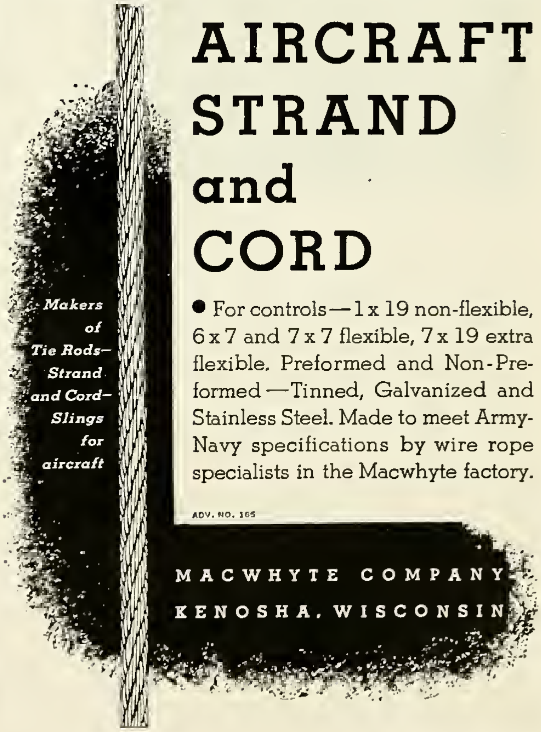

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MACWHYTE COMPANY
KENOSHA, WISCONSIN

LAIRD LC-EW450

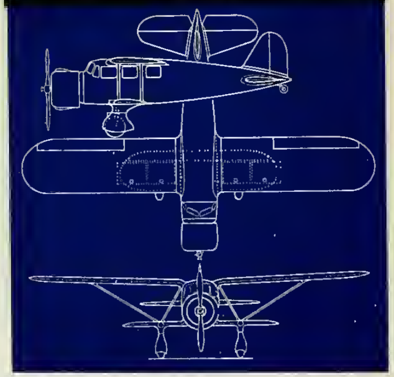
E. M. Laird Airplane Company, Chicago, Illinois

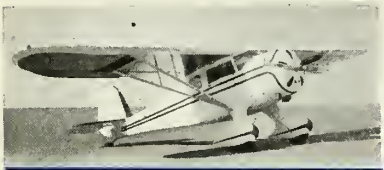
• Six-place sesquiplane. Pratt and Whitney Wasp S1D1 engine, 450 horsepower. Span 38 feet. Length overall 27 feet 6 inches. Height overall 8 feet 8 inches. Wing area 250 square feet. Power loading 11.9 pounds per horsepower. Wing loading 21.3 pounds per square foot. Empty weight 3205 pounds. Useful load 2145 pounds. Payload 1170 pounds. Gross weight 5350 pounds. Fuel capacity 150 gallons. Oil capacity 10 gallons. Maximum speed 200 miles per hour. Cruising speed 175 miles per hour. Landing speed 58 miles per hour. Service ceiling 21,000 feet. Rate of climb 1600 feet per minute. Cruising range 850 miles.

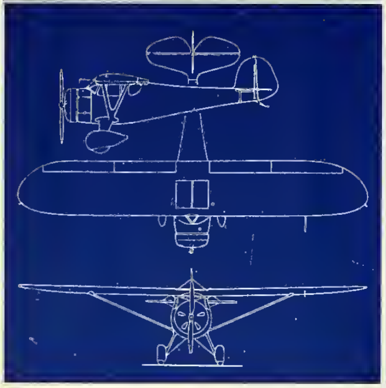
Fuselage: all-metal, 24ST duralumin, of the semi-monocoque type; smooth skin outer covering, 24ST, riveted to elliptical shaped bulkheads formed from 17ST bulb L-sections except main bulkheads at wing root stations which are of two extruded bulb T-sections with a 17ST web riveted between them forming an I cross-section. Wings: upper wing panels and outer tips of lower stub panels are spruce and plywood construction, fabric covered; chrome molybdenum steel tubing is used for inner section of lower stub wings; flaps extend across entire lower wing and fuselage; all-metal 24ST. Tail group: cantilever type, all-metal 24ST; smooth skin; elevator provided with trim tab. Cantilever fixed-type landing gear equipped with General streamlined tires, Bendix wheels and brakes, Cleveland Pneumatic shock absorbers, streamlined metal pants. Fafnir bearings for plane controls.

Standard equipment includes Hamilton Standard metal controllable-pitch propeller, Exide battery, landing lights, radio, Wiley flares, cabin heater, lavatory.

Instruments: compass, air speed indicator, altimeter, turn and bank indicator, rate of climb indicator, Sperry gyro-horizon, Sperry directional gyro, clock, ammeter, engine head temperature indicator, fuel pressure gauge, oil pressure gauge, oil temperature gauge, voltmeter. Also see data in January, 1935, AERO DIGEST.







MONOCOUPE Model 90-A Deluxe

Lambert Aircraft Corporation, St. Louis, Missouri

• President: Wooster Lambert. Vice-president and General Manager: John C. Nulsen. Sales Manager: Clare W. Bunch. Chief Engineer: Tom Towle.

Two-place high-wing monoplane. Lambert R-266 engine, 90 horsepower. Span 32 feet. Length overall 20 feet 6 inches. Height overall, 6 feet 11 inches. Wing area 132.3 square feet. Power loading 17.6 pounds per horsepower. Wing loading 11.9 pounds per square foot. Weight empty 935 pounds. Useful load 650 pounds. Payload 293 pounds. Gross weight 1585 pounds. Fuel capacity 28 gallons. Oil capacity 2.5 gallons. Maximum speed 135 miles per hour. Cruising speed 112 miles per hour. Landing speed (with flaps) 40 miles per hour. Service ceiling 15,000 feet. Rate of climb 900 feet per ninute. Cruising range 625 miles.

Fuselage: welded steel tubing, fabric covered. No internal wire bracing. Side-by-side seating arrangement. Wing: wood, fabric covered; two spruce spars; ribs are built up of bass-wood webs with spruce capstrips; single wire drag bracing and solid compression ribs; sheet aluminum covering on leading edge; Clark "Y" wing section fabric-covered flaps of wood construction between ailerons and fuselage, controlled by independent push-pull type control. Tail group: welded steel tubing, fabric covering. Fixed, divided-type landing gear, consisting of two side Vees, hinged inside the fuselage to the bottom longerons, with horizontal arms extending inwardly from the top of the front members; 6.5 × 10 tires.

Standard equipment includes Hamilton Standard metal propeller, Exide battery, navigation lights, radio bonding, tunnel cowling, fire extinguisher.

Instruments: tachometer, oil pressure gauge, oil temperature gauge, altimeter, clock, air speed indicator. Also see data in July, 1934, AERO DIGEST.

LOCKHEED Altair 8E

Lockheed Aircraft Corporation, Burbank, California

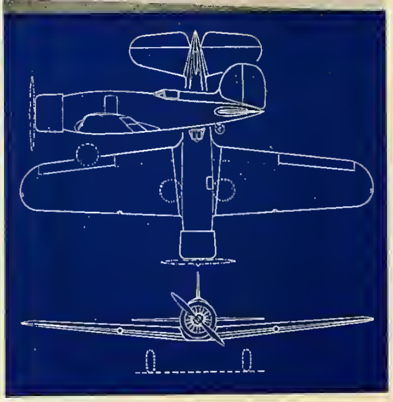
• President and General Manager: Robert E. Gross. Vice-president and Sales Manager: Carl B. Squier. Vice-president and Chief Engineer: Hall L. Hibbard. Export representatives: Miranda Bros., Inc., 6 E. 45th Street, New York City, N. Y. Hosken Trading Company, 56 Pine Street, New York City, New York. Nederlandsche Vliegtuigenfabriek, N. V., Amsterdam, Holland.

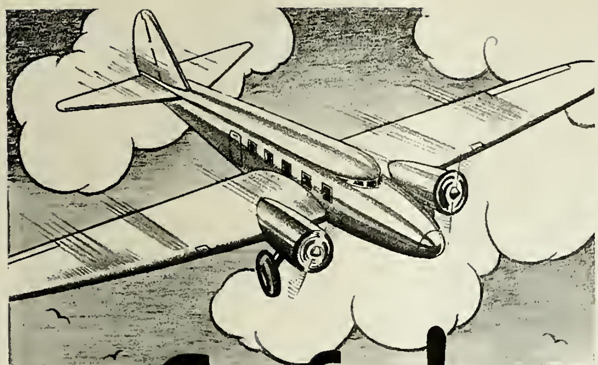
One-place low-wing monoplane. Approval number 2-423. P. & W. Wasp S1D1 engine, 550 horsepower. Span 42 feet 9.25 inches. Length overall 28 feet 11 inches. Height overall 9 feet 3 inches. Wing area 294.1 square feet. Power loading 10.54 pounds per horsepower. Wing loading 19.72 pounds per square foot. Empty weight 3550 pounds. Useful load 2250 pounds. Gross weight 5800 pounds. Fuel capacity 175 gallons. Oil capacity 12 gallons. Maximum speed 220 miles per hour. Cruising speed 205 miles per hour. Landing speed 63 miles per hour. Service ceiling 22,000 feet. Rate of climb 1400 feet per minute. Cruising range 1150 miles.

Fuselage: monocoque construction of spruce, plywood covered. Wing: wood construction, plywood covered, two-spar type; electrically-operated flaps of all-metal stressed skin. Tail group: stressed skin, all wood; retractable landing gear equipped with General streamline tires, Autofan mechanical wheels and brakes and Aerol shock absorbers. Fafnir, Norma-Hoffmann, and SKF bearings for controls.

Standard equipment includes Exide battery, Pyrene fire extinguishers, parking brake, bonding and shielding, Eclipse electric starter. Bosch generator, oil radiator, master switch, Hamilton Standard metal controllable-pitch propeller.

Instruments: Pioneer airspeed indicator, altimeter, rate of climb, turn and bank, tachometer, compass, clock, manifold pressure gauge, fuel pressure warning light. Kollsman triple engine gauge. Weston engine temperature indicator. Motometer fuel gauges.





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For all its high speed and birdlike, darting grace, the modern airplane admits no compromise of safety. That its light tubular framework will bear the great and suddenly reversing strains of flight is never doubted. The supreme requirement of strength and endurance, here as in so many other uses, is answered by *steel.*

To secure the maximum of reliability specify NATIONAL-SHELBY Seamless Aircraft Tubing. Every resource of metallurgy, of engineering and of manufacturing technique is employed to make this product dependable to the highest degree. Accuracy, thoroughness, and vigilance govern at every point in the manufacture and testing of it. All chrome-molybdenum tubes are made from the finest quality electric-furnace steel. To designers and builders of aircraft, NATIONAL engineers will gladly furnish any desired information. Write for literature on NATIONAL-SHELBY—

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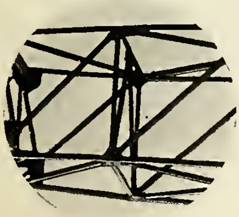

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United States Steel Corporation Subsidiary

NATIONAL-SHELBY AIRCRAFT TUBING

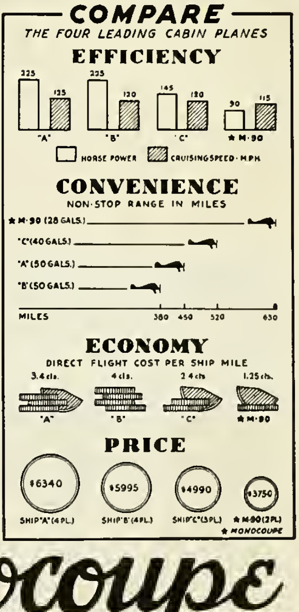
A Business Utility

Cheaper to Run than a Small Car —

Here's a high performance cross-country plane that will go where you want to go—do what you want to do—at a cost of only 1¼c a mile. It has a top speed of 135, cruises at 115, lands at 40, and uses less than 5 gallons of gas per hour. If you want fast, economical transportation Monocoupe has it for you—plus sound engineering and beauty of design and finish that will make you proud to say, "That's my ship."

It's a custom job at a production price and out-performs many planes of greater horse power. Monocoupe is the only cabin plane under $5000 offering transport-type wing flaps as standard equipment. Other features include wheel pants, N.A.C.A. cowling, steel propeller, foot and parking brakes, wider side-by-side seat, finer upholstery, better visibility, controlled ventilation, larger baggage compartment. The whole story of Monocoupe in relation to other cabin planes, each of which costs much more, is told in the accompanying chart. It shows at a glance that in performance and economy Monocoupe stands alone in the field as "America's Finest Private Utility Airplane."

LAMBERT AIRCRAFT CORP.
Robertson, Mo.



The Monocoupe

Mail the Coupon for Details

LAMBERT AIRCRAFT CORP.,
Lambert Field, Robertson, Mo.

Please send folder, specifications, and prices on the new 1935 Monocoupe.

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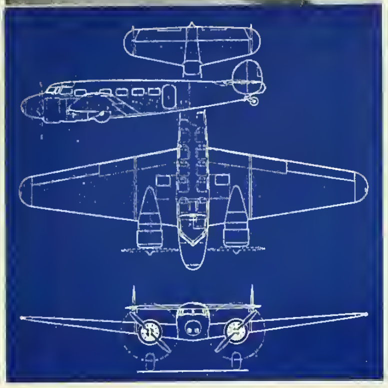


LOCKHEED Electra 10A and 10C

Lockheed Aircraft Corporation, Burbank, California

• Twelve-place low-wing monoplane. (Models 10A and 10C respectively; data on 10C in brackets). ATC 551 (559). P. & W. Wasp Junior SB engine, 400 horsepower; (P. & W. Wasp SC1 engine, 450 horsepower). Span 55 feet. Length overall 38 feet 7 inches. Height overall 10 feet 1 inch. Wing area 458.3 square feet. Power loading 12.19 (11.44) pounds per horsepower. Weight empty 6205 (6710) pounds. Useful load 3545 (3590) pounds. Payload 2200 pounds. Gross weight 9750 (10,300) pounds. Fuel capacity 200 (260) gallons. Oil capacity 14 (17) gallons. Maximum speed 210 (205) miles per hour. Cruising speed 195 (192) miles per hour. Landing speed 63 (65) miles per hour. Service ceiling 21,650 (22,750) feet. Rate of climb 1140 (1050) feet per minute. Cruising range 850 (875) miles.

Fuselage: monocoque construction, all-metal with transverse and longitudinal stringers of channel section. Wing: stressed skin, all-metal; flaps all-metal stressed skin. Tail group: all-metal stressed skin; stabilizer and elevators bolted to fuselage with cantilever vertical fin at each end. Retractable landing gear equipped with Goodyear 35 × 15.6 tires, Goodyear wheels and brakes, Aerol shock absorbers. Engine and plane controls Fafnir, Norma-Hoffmann and SKF ball bearings.

Standard equipment includes landing and navigation lights, Western Electric radio, Lux and Pyrene fire extinguishers, sound insulation, ventilation system, bonding and shielding, Exide battery, Hamilton Standard controllable-pitch propellers.

Instruments: Sperry gyro-horizon, directional gyro. Pioneer compass, altimeter, airspeed indicator, turn and bank, rate of climb, manifold pressure gauge, clock. Kollsman sensitive altimeter, triple engine gauges, fuel gauges. Weston tachometers, engine temperature indicator, air temperature indicator, cabin temperature indicator, volt-ammeter. Landing gear and flap position indicators. Also see data in April, 1934, Aero Digest.

LOCKHEED Orion 9D

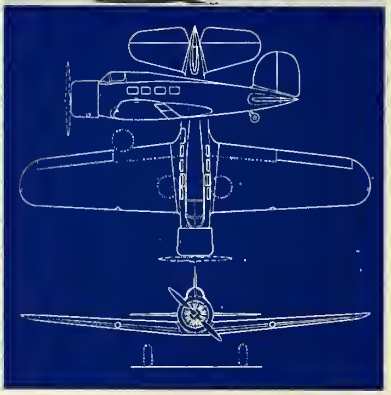
Lockheed Aircraft Corporation, Burbank, California

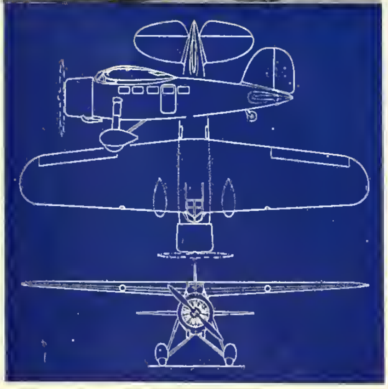
• Seven-place low-wing monoplane. ATC 514. P. & W. Wasp S1D1 engine, 550 horsepower. Span 42 feet 9.25 inches. Length overall 28 feet 4 inches. Height overall 9 feet 8 inches. Wing area 294-1 square feet. Power loading 10.54 pounds per horsepower. Wing loading 19.72 pounds per square foot. Empty weight 3640 pounds. Useful load 2160 pounds. Gross weight 5800 pounds. Fuel capacity 116 gallons. Oil capacity 10 gallons. Maximum speed 225 miles per hour. Cruising speed 205 miles per hour. Landing speed 63 miles per hour. Service ceiling 22,000 feet. Rate of climb 1400 feet per minute. Cruising range 720 miles.

Fuselage: monocoque construction of spruce plywood. Wing: cantilever construction of 2-spar wood type, plywood covered; electrically-operated flaps of stressed skin, all-metal at trailing edge. Tail group: stressed skin, all wood. Retractable landing gear consisting of 2 steel tube pyramids, equipped with General streamline tires. Autofan mechanical wheels and brakes, Aerol shock absorbers. Fafnir, Norma-Hoffmann, and SKF bearings for engine and plane controls. The landing gear units fold inward into a recess in the underside of the wing, with a plate coming up from behind to cover the aperture.

Standard equipment includes landing and navigation lights, Pyrene pressure and hand fire extinguishers, parking brake, bonding and shielding, Eclipse electric starter, Bosch generator, United Aircraft Products oil radiator, master switch, Exide battery. Hamilton Standard controllable-pitch propeller, landing gear position indicator, flap position indicator.

Instruments: Pioneer airspeed indicator, altimeter, rate of climb indicator, turn and bank indicator, tachometer, compass, clock, fuel pressure warning light, manifold pressure gauge. Kollsman triple engine gauge, Weston engine temperature indicator. Motometer fuel gauges.





LOCKHEED Vega 5C

Lockheed Aircraft Corporation, Burbank, California

• Seven-place high-wing monoplane. ATC 384. P. & W. Wasp S3D1 engine, 450 horsepower. Span 41 feet. Length overall 27 feet 6 inches. Height overall 9 feet. Wing area 279.1 square feet. Power loading 10.55 pounds per horsepower. Wing loading 17.02 pounds per square foot. Empty weight 2850 pounds. Useful load 1900 pounds. Gross weight 4750 pounds. Fuel capacity 96 gallons. Oil capacity 10 gallons. Maximum speed 190 miles per hour. Cruising speed 180 miles per hour. Landing speed 61 miles per hour. Service ceiling 18,500 feet. Rate of climb 1300 feet per minute. Cruising range 660 miles.

Fuselage: monocoque construction, spruce plywood; arranged to seat up to six passengers; side entrance door on port side. Wing: wood, plywood covered; cantilever type with modified Clark "Y" wing section, tapering in chord and section from center to tip; built on 2 spruce box spars with spruce girder ribs. Tail group: stressed skin, all wood cantilever type. Fixed landing gear, split-axle type equipped with Goodrich 9.50 × 12 tires, Warner mechanical brakes, Lockheed shock absorbers, streamlined metal wheel fairings; junction of axle and telescopic leg braced by thrust tube running back to center-line of fuselage. Fafnir, Norma-Hoffmann and SKF bearings for engine and plane controls. Main fuel tanks are located in the wings.

Standard equipment includes Exide battery, landing lights, navigation lights, Pyrene pressure fire extinguisher, Pyrene hand fire extinguisher, complete bonding and engine radio shielding, Eclipse electric starter, Bosch generator, United Aircraft Products oil radiator, master switch, Scintilla ignition switch, Hamilton Standard controllable-pitch propeller.

Instruments: Pioneer airspeed indicator, altimeter, turn and bank indicator, tachometer, compass, clock, manifold pressure gauge, fuel pressure warning light. Kollsman triple engine gauge. Motometer electrical fuel gauges.

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American Eagle-Lincoln Aircraft Corp.
Beech Aircraft Co.
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LUSCOMBE Phantom

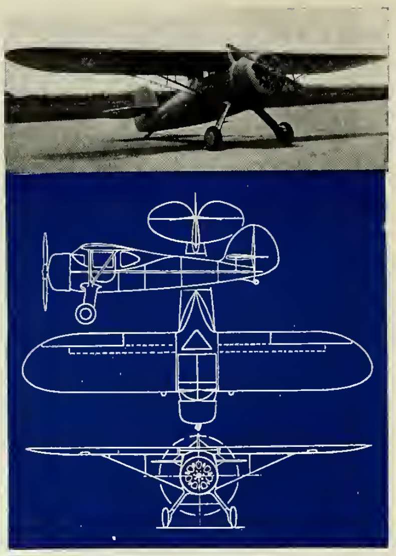
Luscombe Airplane Corporation, West Trenton, New Jersey

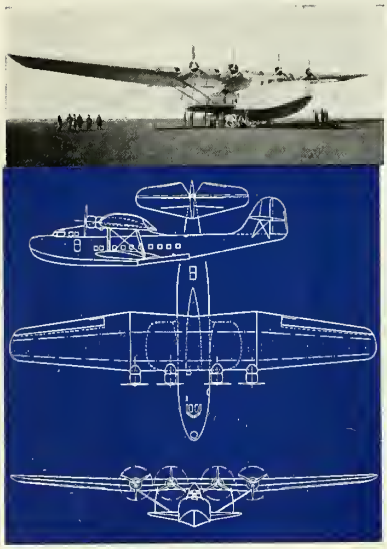
• Two-place high-wing monoplane. Warner Super Scarab engine, 145 horsepower. ATC 552. Span 31 feet. Length overall 21 feet 6 inches. Height overall 6 feet 9 inches. Wing area 132 square feet. Power loading 13.5 pounds per horsepower. Wing loading 14.8 pounds per square foot. Empty weight 1300 pounds. Useful load 650 pounds. Payload 236 pounds. Gross weight 1950 pounds. Fuel capacity 35 gallons. Oil capacity 3.75 gallons. Maximum speed 168 miles per hour. Cruising speed 144 miles per hour. Landing speed 45 miles per hour. Service ceiling 19,000 feet. Rate of climb 1400 feet per minute. Cruising range 560 miles.

Fuselage: all-metal construction of duralumin; full monocoque; side-by-side seating arrangement with duralumin dual controls; 8 cubic foot baggage compartment behind seat, accessible in flight; seat cushions removable to allow use of parachute; two large unobstructed doors on each side of the cabin; top and rear windows. Wing: fabric covered; all-metal construction; extruded dural I beams; stamped dural ribs; flaps are of stainless steel, shot welded; electrically or manually operated, extend across greater portion of wing span. Tail group: fabric covered movable surfaces; duralumin sheet and welded steel tubing; stabilizer adjustable in flight. Fixed type cantilever landing gear equipped with 18-inch General streamlined tires, Autofan wheels and brakes, oleo and spring shock absorbers; tail wheel assembly combination of leaf spring supported by a vertical member with rubber discs.

Standard equipment includes Hartzell wood propeller, Exide battery, heat and ventilation control systems, complete electrification and individually fused with wire in aluminum conduits, wired for radio, rubber mounted instrument panel.

Instruments: air speed indicator, altimeter, tachometer, compass, fuel gauge, oil pressure gauge, oil temperature gauge, compass. Also see data in September, 1934, Aero Digest.





MARTIN Model 130

The Glenn L. Martin Company, Baltimore, Maryland

• President: Glenn L. Martin. Vice-president and Assistant General Manager: L. C. Milburn. Chief Engineer: B. C. Boulton.

Fifty-place closed high-wing flying boat. Four Pratt & Whitney twin-row Wasp (geared) engines, 800 horsepower each. Span 130 feet. Length overall 90 feet 10.5 inches. Height overall 24 feet 7 inches. Wing area (including sponsons or "sea wings") 2315 square feet. Power loading 15.9 pounds per horsepower. Wing loading 22 pounds per square foot. Weight empty 23,000 pounds. Useful load 28,000 pounds. Payload varies with range. Gross weight 51,000 pounds. Fuel capacity 4000 gallons. Maximum speed 180 miles per hour at 8000 feet. Cruising speed 155 miles per hour. Landing speed 70 miles per hour. Cruising range 4000 miles.

Hull: two step type, aluminum alloy construction, transverse bulkheads and frames, supplementary keelson, corrugated bottom skin and deck covering, smooth side skin. Four watertight bulkheads. Sponsons: riveted aluminum alloy, longitudinal and transverse framing, corrugated bottom skin, smooth top skin. Wing: riveted aluminum alloy, braced center-section, cantilever outer panels. Box girder type primary structure with tension field web beams acting as side members, smooth stressed-skin bottom covering, corrugated sheet top with corrugations parallel to span and covered by thin smooth sheet. Stiffeners added to beam webs and former-ribs support corrugations. Nose ribs and metal leading edge covering attached to front beam. Tail ribs and fabric covering attached to rear beam. Balanced ailerons, metal framework, fabric covered. No flaps. Tail group: Riveted aluminum alloy stub fin integral with hull. Wire-braced stabilizer, detachable upper fin, riveted aluminum alloy framework, fabric covered. Balanced elevator and rudder. Hamilton Standard controllable-pitch propellers. Also see data in January, 1935, Aero Digest.

MERCURY Chic T-2

Mercury Aircraft, Incorporated, Hammondsport, N. Y.

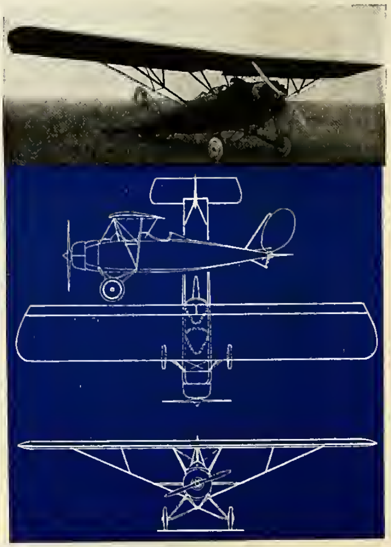
• President and General Manager: J. F. Meade. Vice-president and Chief Engineer: H. C. Mummert.

Two-place open high-wing monoplane. ATC 235. LeBlond engine, 90 horsepower. Span 35 feet 8 inches. Length overall 23 feet. Height overall 8 feet 7 inches. Wing area 192 square feet. Chord 66 inches. Empty weight 935 pounds. Useful load 578 pounds. Payload 366 pounds. Gross weight 1513 pounds. Fuel capacity 28 gallons. Oil capacity 4 gallons. Maximum speed 115 miles per hour. Cruising speed 95 miles per hour. Landing speed 40 miles per hour. Service ceiling 18,000 feet. Rate of climb 900 ft./min. Cruising range 375 miles.

Fuselage: welded chrome molybdenum steel tubing, fabric covered; tandem cockpits, with adjustable seats and dual controls. Wing; steel tubing; the wing is in two sections joined on the center line; strut supports are utilized to brace the wings above the fuselage; Vee struts brace the wings to the bottom of the fuselage attaching to the bottom fuselage longerons; spars and ribs are of chrome molybdenum steel tubing; ailerons extend across full width of the wings and are actuated by vertical tubes attached directly to the control stick, eliminating all cables and pulleys from the aileron system; flaps are of steel tubing, covered with fabric. Tail group: steel tube framework, fabric covered; no fin; the balanced rudder, with the rudder post is braced to the top of the fuselage by two converging steel-tube struts; no stabilizer, but balanced one-piece elevator. Fixed split-type landing gear, consisting of two Vees hinged to the bottom fuselage longerons, and two half-axles, the inner ends of which are anchored to the apex of a steel-tube pyramid below the fuselage by a rubber cord shock absorber; the landing gear is equipped with 28 × 4 tires and Kelsey-Hayes wheels.

Standard equipment includes navigation lights and a Hartzell wood propeller.

Instruments: tachometer, altimeter, oil temperature gauge, oil pressure gauge.



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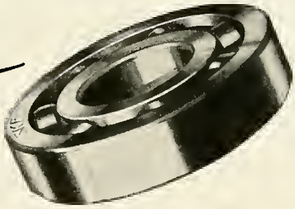

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SKF

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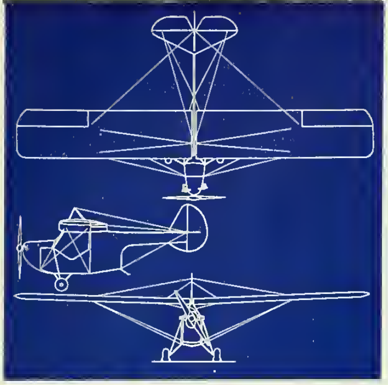


NATIONAL Bluebird

National Airplane and Motor Company, Billings, Montana

• President and General Manager: A. B. Green. Vice-president: R. J. O'Malley. Chief Engineer: Hugh Thompson.

Two-place open high-wing monoplane. National 35 engine. 35 horsepower. Approval 2-465. Span 36 feet. Length overall 20 feet. Height overall 8 feet. Wing area 175 square feet. Chord 59 inches. Aileron area 22.5 square feet. Fin area 5.68 square feet. Rudder area 7.51 square feet. Stabilizer area 11.65 square feet. Elevator area 8.65 square feet. Power loading 25.7 pounds per horsepower. Wing loading 5.14 pounds per square foot. Empty weight 450 pounds. Useful load 450 pounds. Payload 200 pounds. Gross weight 900 pounds. Fuel capacity 10 gallons. Oil capacity 1.5 gallons. Maximum speed 85 miles per hour. Cruising speed 78 miles per hour. Landing speed 27 miles per hour. Service ceiling 14,000 feet. Rate of climb 490 feet per minute. Cruising range 312 miles.

Fuselage: fabric covered; steel tubing; side-by-side seating arrangement; Pyralin windshield; short nacelle-type fuselage with single outrigger tail boom wire-braced to wings and faired into the nacelle; metal covered forward of the cockpit; nacelle structural members are disposed so as to permit easy access to cockpit. Wings: fabric covered; two sections; spars solid spruce; ribs spruce; wire braced to bottom fuselage longerons, to inverted Vee-type cabane strut above wing and to tail post. Tail group: fabric covered; braced by means of wires from the cabane strut as well as from a point on the nacelle after the tail skid, and from the rear wing beams inboard of the ailerons. Fixed split type landing gear equipped with 16 × 7 × 3 airwheels and cord ring shock absorbers; solid tube tail skid at rear of nacelle, permitting easy ground maneuvering.

Standard equipment includes Hartzell wood propeller.

Instruments: tachometer, oil pressure gauge, oil temperature gauge, and an altimeter.

NORTHROP Gamma 2-D

The Northrop Corporation, Inglewood, California

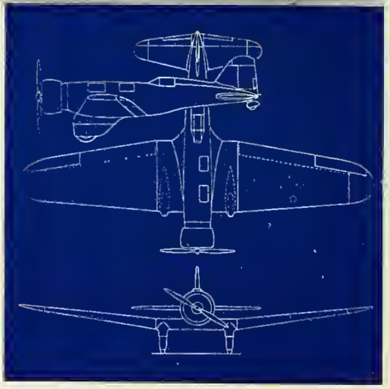
• President: John K. Northrop. Vice-president, General Manager and Sales Manager: W. K. Jay. Export representative: E. P. Howard, 51 Canton Road, Shanghai, China.

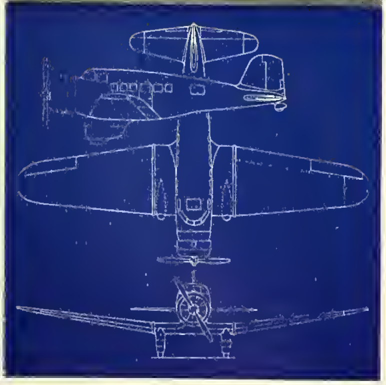
One-place open (or closed) low-wing mail monoplane. ATC 549. Wright Cyclone SR1820 F-3 engine, 710 horsepower at 7000 feet. Span 47 feet 9.5 inches. Length overall 31 feet 2 inches. Height overall 9 feet. Wing area 363 square feet. Power loading 10.3 pounds per horsepower. Wing loading 21.2 pounds per square foot. Empty weight 4119 pounds. Useful load 3231 pounds. Payload 1173 pounds. Gross weight 7350 pounds. Fuel capacity 334 gallons. Oil capacity 22 gallons. Maximum speed 224 miles per hour. Cruising speed 215 miles per hour. Landing speed 60 miles per hour. Service ceiling 20,000 feet. Rate of climb 1200 feet per minute. Cruising range 1700 miles.

Fuselage: all-metal monocoque construction; center section of wing built integral with fuselage; sliding hood. Wing: all-metal multi-cellular construction; two outer panels are separate from center section of wing; electrically-operated all-metal flaps on outer panels. Tail group: all-metal multi channel construction; balanced; trim tabs on rudder and elevators; fin and stabilizer fixed. Fixed-type cantilever landing gear with 36 × 8 tires, Bendix wheels and mechanical brakes, oleo pneumatic shock absorbers; fully streamlined. Engine and plane controls ball or roller bearing equipped.

Standard equipment includes retractable or fixed leading edge landing lights, wing tip navigation lights, Navy-type standard tail lights, Hamilton Standard controllable-pitch propeller.

Usual flight and engine instruments including Sperry directional gyro, Sperry artificial horizon, ice warning indicator, rate of climb indicator. Also see data in January, 1933, AERO DIGEST.





NORTHROP Delta 1-D

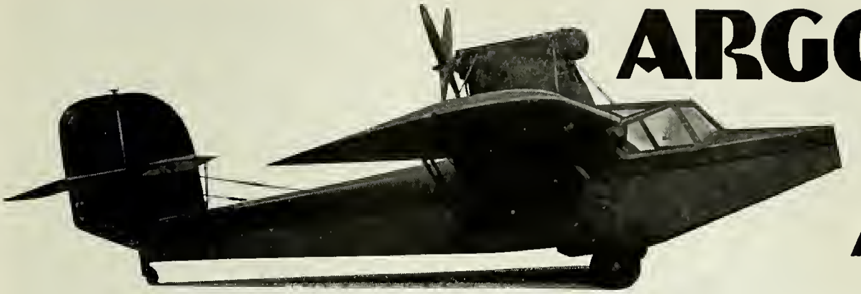
The Northrop Corporation, Inglewood, California

• Five- or eight-place low-wing monoplane. ATC 553. Wright Cyclone SR1820 F-3 engine, 710 horsepower at 7000 feet, or Wright Cyclone SR1820 F-2 engine, 735 horsepower at 4000 feet or P. & W. of equivalent power. Span 47 feet 9.5 inches. Length overall 33 feet 1.125 inches. Wing area 363 square feet. Power loading 10.3 pounds per horsepower. Wing loading 21.2 pounds per square foot. Empty weight 4540 pounds. Useful load 2810 pounds. Payload 1295 pounds. Gross weight 7350 pounds. Fuel capacity 328 gallons. Oil capacity 22 gallons. Maximum speed 223 miles per hour. Cruising speed 210 miles per hour. Landing speed 60 miles per hour. Service ceiling 20,000 feet. Rate of climb 1200 feet per minute. Cruising range 1700 miles.

Fuselage: all-metal monocoque construction; center section of wing built integral with fuselage. Wings: all-metal multi-cellular cantilever construction; two outer wings are separate from center section of wing; electrically operated all-metal flaps on outer wings. Tail group: all-metal multi-cellular cantilever construction; balanced; fin and stabilizer fixed; rudder and elevator equipped with trim tabs on trailing edge, adjustable from cockpit. Fixed-type cantilever strut-type fully enclosed and streamlined landing gear equipped with 36 × 8 tires, Bendix wheels and hydraulic brakes. oleo pneumatic shock absorbers. Engine and plane controls ball or roller bearing equipped.

Standard equipment includes retractable or fixed leading edge landing lights in the wings, navigation lights, fully equipped lavatory optional, Hamilton Standard two- or three-bladed controllable-pitch propeller.

Usual flight and engine instruments including Sperry directional gyro, Sperry gyro-horizon, ice warning indicator, rate of climb indicator, tachometer, air speed indicator, oil temperature gauge, oil pressure gauge. Also see data in December, 1933, AERO DIGEST.



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3-place cabin flying-boat type, pusher Amphibian (Menasco C4 PIRATE Engine, 125 H.P.).

Span 35 ft. 4 in.; length 26 ft.; height overall 8 ft. 2 in.

Gross wt., fully loaded, 1870 lbs.
Gasoline, 40 gallons....240 lbs.
Payload (in place of 2 passengers plus 100 lbs. baggage) 440 lbs.
Maximum speed ....120 MPH
Cruising speed ......104 MPH
Landing speed ...... 40 MPH
Rate of climb. 1000 ft. per min.
Cruising range......500 miles

Standard equipment includes starter, cabin heater, brakes, anchor, navigation lights; wobble pump, engine-driven fuel pump. Instruments: airspeed, compass, tachometer, fuel gauge, ammeter, voltmeter, altimeter, oil pressure, oil temperature, pitch and bank indicator, switch, fuel pressure.

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GYROPLANE XOZ-1

Pennsylvania Aircraft Syndicate, Ltd., Philadelphia, Pennsylvania

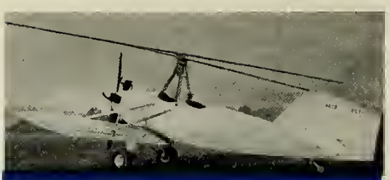
• President: E. Burke Wilford. Chief Engineer: Elliott Daland.

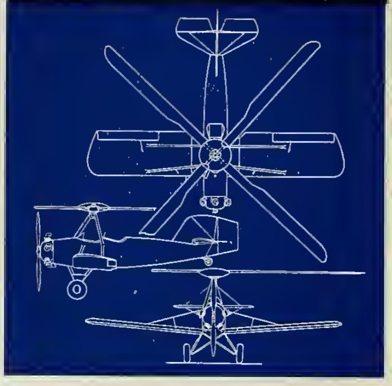
Two-place open gyroplane. Kinner R-5 engine, 155 horsepower at 1975 revolutions per minute. Span of fixed wing 27 feet 4 inches. Rotor diameter 32 feet. Length overall 21 feet 4 inches. Height overall 10 feet. Tread 67.5 inches. Wing area 110 square feet. Chord 55 inches. Rotor disc area 804 square feet. Rotor blade area 68.3 square feet. Power loading 12.8 pounds per horsepower. Wing loading 18 pounds per square foot. Rotor disc loading 2.47 pounds per square foot. Empty weight 1455 pounds. Useful load 530 pounds. Gross weight 1985 pounds. Fuel capacity 16 gallons. Oil capacity 3 gallons. Maximum speed 107 miles per hour. Cruising speed 90 miles per hour. Landing speed 30 miles per hour. Cruising range 148 miles.

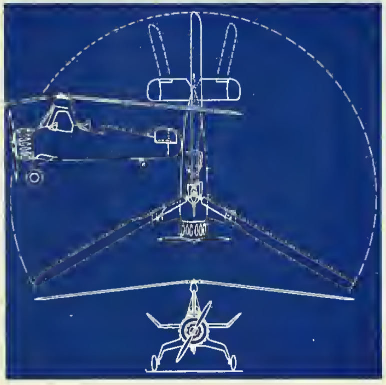
Fuselage: welded chrome molybdenum steel tubing, fabric covered; tandem seating arrangement. Wing: wood spars, dural ribs, fabric covered; strut-braced to fuselage; blades of rotor restrained at hub both in horizontal and vertical planes and are free to twist, or feather, only; opposite blades of the four-bladed rotor are connected rigidly together, so that as the angle of attack on one side increases, that on the opposite side decreases; blade angles controlled laterally and longitudinally by motion of control stick which also controls ailerons and elevators. Tail group: steel tubing, fabric covered; wire braced to bottom fuselage longerons. Fixed type landing gear equipped with 7.50 × 10 Goodrich tires, Autofan wheels and brakes, Fleet shock absorbers. Norma-Hoffmann and SKF bearings for rotor and plane controls.

This is primarily a training and utility gyro and can be equipped with Edo twin floats.

Instruments: engine tachometer, rotor tachometer, altimeter, air speed indicator, oil pressure gauge, oil temperature gauge. Also see data in February, 1932, and February, 1935, Aero Digest.







PITCAIRN Model PA-33

Pitcairn Autogiro Company, Willow Grove, Pennsylvania

• President: Harold F. Pitcairn. Vice-president: James G. Ray. Chief Engineer: Agnew E. Larsen.

Two-place open direct control autogiro. Wright Whirlwind R-975E engine, 420 horsepower at 2150 revolutions per minute. Diameter of rotor 46 feet 2 inches. Length overall 21 feet 10 inches. Height overall 11 feet 1 inch. Rotor disc area 1675 square feet. Rotor blade area 84.5 square feet. Vertical tail area 8.15 square feet; horizontal tail area 21.80 square feet; angular tip area 11.8 square feet. Power loading 7.62 pounds per horsepower. Disc loading 1.91 pounds per square foot. Empty weight 2300 pounds. Useful load 900 pounds. Gross weight 3200 pounds. Fuel capacity 66 gallons. Maximum speed 141.8 miles per hour. Cruising speed 113.5 miles per hour. Landing speed nil. Service ceiling 15,275 feet. Rate of climb 1485 feet per minute. Cruising range 337 miles.

Fuselage: fabric covered; welded steel tubing; tandem seating arrangement; dual control. Blades: fabric covered; spars 4130-X steel single tubular spar-type; ribs plywood routed-type. Tail group: fin, rudder and stabilizer but no elevators; control in roll and pitch is accomplished through the tilting of the rotor blades. Landing gear fixed type with cantilever supports with telescoping shock struts. Streamline wheels. Cleveland Pneumatic splined strut shock absorbers.

Equipment includes landing flares, combined hand and electric inertia engine starter, hydraulic brakes and parking brake.

Provision can be made for folding the blades for storage in a shed or garage. A complete complement of flight and engine instruments is installed, with duplicate flight instruments in the front cockpit.

The machine as built includes one of several general types under development by the Autogiro Company of America for which concern it was built by the Pitcairn Autogiro Company.

PORTERFIELD Flyabout

Porterfield Aircraft Corporation, Kansas City, Missouri

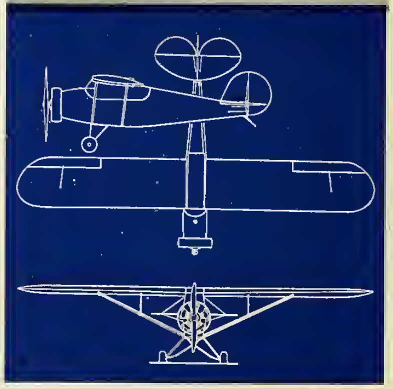
• President and General Manager: E. E. Porterfield, Jr. Vice-president: M. S. Porterfield. Designer and Production Manager: N. R. Hockaday. Chief Engineer: Hugh L. Thompson.

Two-place high-wing monoplane. LeBlond engine, 70 horsepower. Span 32 feet. Length overall 20 feet. Height overall 6 feet 7 inches. Wing area 145 square feet. Tail area 34.24 square feet. Wheel tread 66 inches. Chord 54.5 inches. Power loading 17.6 pounds per horsepower. Empty weight 750 pounds. Useful load 485 pounds. Payload 195 pounds. Gross weight 1235 pounds. Fuel capacity 17 gallons. Oil capacity 2.5 gallons. Maximum speed 120 miles per hour. Cruising speed 105 miles per hour. Landing speed 40 miles per hour. Service ceiling 16,000 feet. Rate of climb 800 feet per minute. Cruising range 315 miles.

Fuselage: Grade A Flightex fabric covered; chrome molybdenum steel tubing, Warren truss type structure; tandem seating arrangement with dual controls; baggage compartment; pyralin top and sides. Wings: fabric covered; spruce spars, built up ribs; strut braced by streamlined steel tubes on either side of fuselage. Tail group: fabric covered; chrome molybdenum steel tubing; large control surfaces; stabilizer adjustable in flight from cockpit; wire braced to fuselage with Macwhyte products. Six coats of Berryloid nitrate dope are used and several coats of handrubbed Berryloid lacquer. Vee-type landing gear equipped with Goodrich 7.00 × 4 tires, Shinn hub, Rusco ring shock absorbers; stressed for wheel brakes. Leaf-spring tail skid.

Standard equipment includes wood propeller, wiring for navigation lights, ignition switch, Pyrene fire extinguisher. Optional equipment includes Townend type ring, tail wheel, storage battery. Also available with 65 horsepower Velie engine.

Instruments: altimeter, oil temperature gauge, oil pressure gauge, tachometer, fuel gauge. Also see data in August, 1934, Aero Digest.



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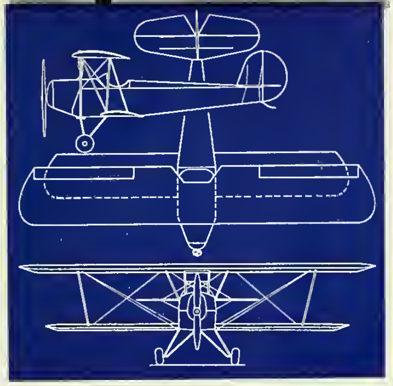


WILEY POST Model A

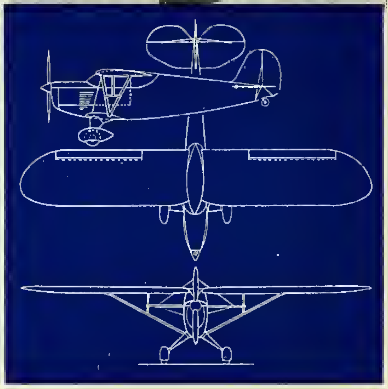
Wiley Post Aircraft Corporation, Oklahoma City, Oklahoma

• President: Wiley Post. Vice-president: Mark Kleeden. Secretary and Treasurer: Thomas J. Ruddy. General Manager: J. H. Burke. Chief Engineer: Evert Stong.

Two-place open biplane. Straughan AL-1000 (Ford Model 1A) engine, 40 horsepower. ATC 561. Span upper wing 28 feet 6 inches, span lower wing 24 feet 6 inches. Length overall 19 feet 9 inches. Height overall 7 feet 8 inches. Wing area of upper wing 126.7 square feet. Wing area of lower wing 79.33 square feet. Chord 56 inches. Power loading 25 pounds per horsepower. Wing loading 4.8 pounds per square foot. Empty weight 581 pounds. Useful load 417 pounds. Payload 170 pounds. Gross weight 998 pounds. Fuel capacity 7 gallons. Oil capacity 1.25 gallons. Maximum speed 80 miles per hour. Cruising speed 70 miles per hour. Landing speed 25 miles per hour. Service ceiling 10,000 feet. Rate of climb 600 feet per minute.

Fuselage: fabric covered fuselage of welded chrome molybdenum tubing construction with side-by-side seating arrangement, and dual controls. Wings are fabric covered; spruce and mahogany plywood construction; the top wing is carried above the fuselage on splayed out steel struts attached at the bottom ends of the top fuselage longerons on either side of the fuselage; inset ailerons are on the top wing; cut-away center section for improved visibility; wire braced *N*-type interplane struts between wings; radiator carried below center section. Tail group: fabric covered; chrome molybdenum tubing construction; fixed stabilizer; all surfaces wire-braced. The landing gear is of split-type construction and is equipped with 16 × 7 × 3 airwheels and rubber cord shock absorbers; consists of Vee-type legs. The tail skid is of the leaf spring type.

Standard equipment includes a Stone wood propeller, tachometer, altimeter, oil temperature gauge, fire extinguisher, first aid kit, log book, dual controls.



REARWIN Speedster Model 6000

Rearwin Airplanes, Incorporated, Fairfax Airport, Kansas City, Kansas

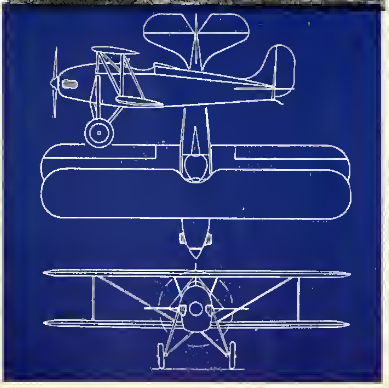
• President and General Manager: R. A. Rearwin. Vice-president: Albert R. Jones. Sales Manager: George M. Prescott. Chief Engineer: William Henry Weeks.

Two-place high-wing monoplane, American Cirrus Hi-drive inverted engine, 95 horsepower or Menasco. Span 32 feet. Length overall 21 feet 6 inches. Height overall 6 feet 6 inches. Wing area 145 square feet. Power loading 16.9 pounds per horsepower. Wing loading 11.05 pounds per square foot. Empty weight 992 pounds. Useful load 613 pounds. Payload 220 pounds. Gross weight 1605 pounds. Fuel capacity 34 gallons. Oil capacity 2.5 gallons. Maximum speed 144 miles per hour. Cruising speed 120 miles per hour. Landing speed 39 miles per hour. Rate of climb 800 feet per minute. Cruising range 600 miles.

Fuselage: welded steel tube chrome molybdenum structure, fabric covered; tandem seating arrangement, dual controls; baggage compartment below and behind rear seat. Wing: wood construction, fabric covered; two laminated spruce spars and girder-type spruce ribs; braced to bottom fuselage longerons by Vee struts; rectangular shaped, with elliptical tips and "gulled" at roots. Tail group: framework of steel tubing, fabric covered; wire braced adjustable stabilizer. Fixed cantilever type landing gear equipped with 7.00 × 5 Autofan or Bendix wheels and brakes, Rusco ring shock absorbers and streamline pants. Steerable tail wheel with 8 × 3.25 Goodyear streamlined tire.

Standard equipment includes Hamilton Standard variable-pitch propeller, navigation lights, control panel lights. Exide battery optional.

Instruments: airspeed indicator, compass, tachometer, altimeter, oil pressure gauge, oil temperature gauge. Also see data in March, 1935, Aero Digest.



ROSE Parrakeet Model A-1

Rose Aeroplane and Motor Company, Chicago, Illinois

• President and General Manager: J. W. Rose. Vice-president: Earl Howe. Sales Manager: Ray Applegate. Chief Engineer: William I. Stieglitz.

One-place open biplane. Continental A-40 engine, 37 horsepower. Span 20 feet. Length overall 17 feet 6 inches. Height overall 5 feet 8 inches. Wing area 116 square feet. Power loading 18.2 pounds per horsepower. Wing loading 5.8 pounds per square foot. Empty weight 410 pounds. Useful load 265 pounds. Gross weight 675 pounds. Fuel capacity 10 gallons. Oil capacity 1 gallon. Maximum speed 100 miles per hour. Cruising speed 85 miles per hour. Landing speed 30 miles per hour. Service ceiling 12,000 feet. Rate of climb 750 feet per minute. Cruising range 340 miles.

Fuselage: fabric covered and rubbed Berryloid high-luster finish; fairing is of spruce; welded steel tube framework, with a detachable engine mount. Wings: fabric covered; spars are solid spruce and are held by a double system of compression members and a single set of tie rods; ribs are of plywood and spruce and are glued and nailed; the trailing edge of the wing is of reinforced aluminum; ailerons are of spruce and plywood, glued and nailed and are actuated by a torque tube within the wing and are available only on the lower wing; interplane struts are of streamlined tubing; cabane bracing is by two streamline tie rods. Tail group: fabric covered; welded steel tubing; braced by single system of streamline tie rods. Split-axle type landing gear equipped with 16 × 4 Goodyear tires, and 16 × 4 aluminum disk wheels and cord shock absorbers.

Standard equipment includes Gardner wood propeller, hand fire extinguisher, switch, primer, windshield, streamline head rest, aluminum fuel tank engine cowl and propeller spinner, Arens engine controls, engine tools.

Instruments: altimeter, tachometer, oil pressure gauge, oil temperature gauge, fuel gauge.

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RYAN Model S-T

Ryan Aeronautical Company, San Diego, California

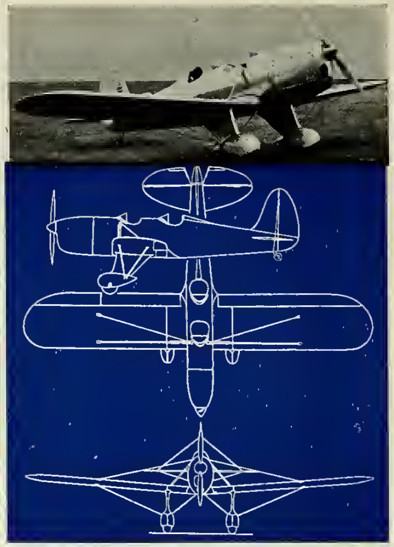
• President and General Manager: T. Claude Ryan. Vice-president and Sales Manager: Earl D. Prudden. Chief Engineer: William Vandermeer.

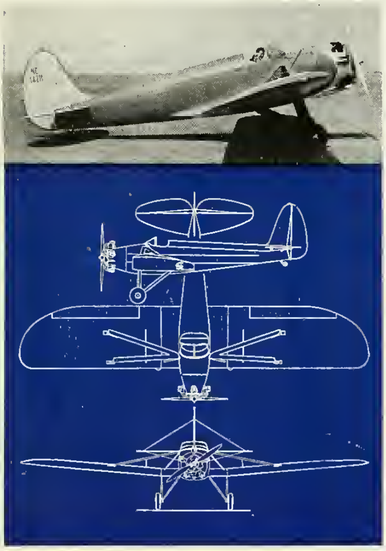
Two-place open low-wing monoplane. Menasco B-4 engine, 95 horsepower. ATC 541. Span 29 feet 11 inches. Length overall 21 feet 8 inches. Height overall 6 feet 11 inches. Chord 56 inches. Power loading 16.5 pounds per horsepower. Wing loading 12.5 pounds per square foot. Empty weight 1027 pounds. Useful load 543 pounds. Payload 210 pounds. Gross weight 1570 pounds. Fuel capacity 24 gallons. Oil capacity 2.5 gallons. Maximum speed 140 miles per hour. Cruising speed 120 miles per hour. Landing speed 40 miles per hour. Service ceiling 15,000 feet. Rate of climb 850 feet per minute. Cruising range 400 miles.

Fuselage: monocoque construction, all-metal Alclad and 17 ST; elliptical cross-section; tandem seating arrangement, dual controls; adaptable for sliding cockpit enclosure. Wing: fabric covered; spars of composite spruce; ribs and compression members of metal; nose of wing covered by 17 ST sheet; braced by streamlined wires; ailerons are of metal structure operated by a torque tube from the control stick; they are of the modified Friese type with differential action; flaps are of metal construction, fabric covered; extend over approximately two-thirds the wing span. Tail group: 17 ST alloy construction, fabric covered; trim tabs on trailing edge of elevators. Fixed treadle-type fully streamlined landing gear equipped with Goodyear 18 × 8.5 airwheels, Goodyear multiple disc brakes, Cleveland Pneumatic hydraulic shock absorbers; full swivelling tail wheel with castor action through 360°. Engine and plane controls of Micarta, graphite impregnated bearings.

Standard equipment includes wiring for navigation lights, Hartzell wood propeller.

Instruments: tachometer, oil pressure gauge, temperature indicator, altimeter, compass, air speed indicator. Also see data in July, 1934, Aero Digest.





SECURITY Airster Model S-1A

Security National Aircraft Corporation, Van Nuys, California

• President and General Manager: W. B. Kinner. Vice-president: A. C. Essig. Sales Manager: Hugh H. Green. Chief Engineer: Max B. Harlow.

Two-place open low-wing monoplane. Security S-5 engine, 120 horsepower. ATC 521. Span 40 feet. Length overall 23 feet 11 inches. Height overall 7 feet 9 inches. Wing area 240 square feet. Chord 84 inches. Power loading 17.75 pounds per horsepower. Wing loading 6.75 pounds per square foot. Empty weight 1197 pounds. Useful load 578 pounds. Payload 244.5 pounds. Gross weight 1775 pounds. Fuel capacity 25 gallons. Oil capacity 3 gallons. Maximum speed at 1900 r.p.m. 110 miles per hour. Cruising speed at 1800 r.p.m. 100 miles per hour. Landing speed 35 miles per hour. Service ceiling 14,000 feet. Rate of climb 1000 ft. per min. Cruising range 300 miles.

Fuselage: fabric covered; welded 4130 tubing; side-by-side seating arrangement, dual controls; coupé enclosure optional equipment; baggage compartment in fuselage aft of seats; engine mount can be swung around at 90°. Wing: fabric covered; wood construction; folding wings; outer panels attach to short stub center section braced to fuselage by a strut intended to transmit the oleo leg loads directly into the fuselage structure. Tail group: fabric covered; welded 4130 tubing; adjustable stabilizer. Fixed divided type landing gear equipped with Goodrich 6.50 × 10 tires, Autofan wheels and brakes, oleo shock absorbers; fully swivelling tail wheel with solid rubber tires. Also adaptable for installation of twin float equipment. Engine controls plain and roller bearing equipped.

Standard equipment includes Story or Hamilton Standard metal propeller, battery, navigation lights, electric starter, switch, hand fire extinguisher.

Instruments: tachometer, altimeter, oil pressure gauge, oil temperature gauge. Also see data in July, 1933, Aero Digest.

SEVERSKY Model SEV-3M

Seversky Aircraft Corporation, Farmingdale, New York

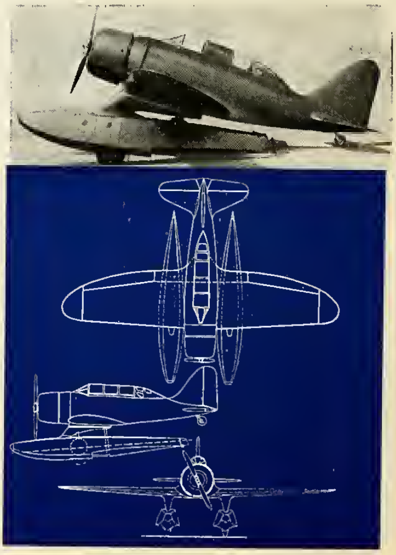
• President: Alexander P. de Seversky. Vice-president: R. G. Ervin. Chief Engineer: A. Kartveli. Export representative: Miranda Bros., 6 E. 45th Street, New York, N. Y.

Two- or three-place open amphibion. Wright Whirlwind engine, 420 horsepower. Span 36 feet. Length overall 26 feet 4 inches. Height overall 9 feet 9 inches. Wing area 209 square feet. Empty weight 2545 pounds. Useful load 1655 pounds. Gross weight 4200 pounds. Fuel capacity 130 gallons. Maximum speed 185 miles per hour. Cruising speed 160 miles per hour. Landing speed 55 miles per hour. Service ceiling 16,000 feet. Rate of climb 1100 feet per minute. Cruising range 1000 miles.

Fuselage: monocoque all-metal construction; front main bulkhead connecting to corresponding web of each box section of the wing; five points of attachment on each side at junction of wing and fuselage precluding need of special reinforcement for concentrated loads, stresses being distributed along skin. Wing: multi-box all-metal construction; smooth outer skin reinforced with corrugated sheet on inside running along span; bottom skin stiffened by panel section at intervals in width of sheet making channel shape which forms closed box section extending length of skin; split trailing edge all-metal flaps between ailerons. Tail group: all-metal cantilever construction; fin built integral with fuselage; adjustable stabilizer secured at four points of attachment. Amphibion landing gear convertible to straight landplane; equipped with General streamlined tires.

Standard equipment includes Lycoming-Smith controllable-pitch propeller, wheel brakes, water rudders, automatic anchor, convertible cockpit.

Instruments: tachometer, fuel pressure gauge, oil temperature gauge, oil pressure gauge, altimeter, rate of climb indicator, air speed indicator, bank and turn indicator, compass, clock, ammeter, voltmeter, fuel gauge. Also see data in July, 1933, Aero Digest.



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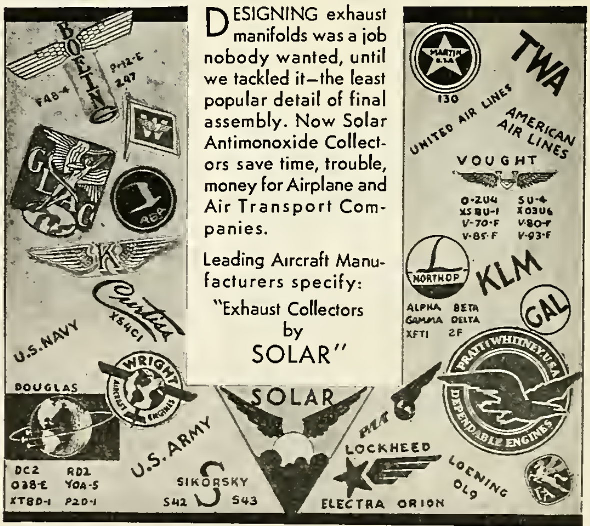

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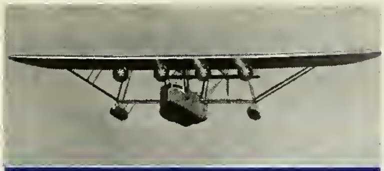
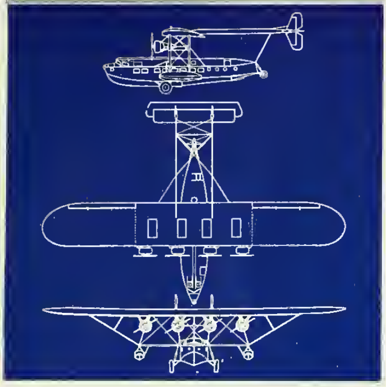




SIKORSKY S-40

Sikorsky Aircraft Corporation, Bridgeport, Connecticut

• President: Fred W. Neilson. Vice-president in charge of engineering: Igor I. Sikorsky.

Forty-five place high-wing seaplane. ATC 454. Four P. & W. Hornet engines, 575 horsepower each. Span 114 feet. Length overall 76 feet 8 inches. Height overall 23 feet 10 inches. Wing area 1740 square feet. Power loading 14.8 pounds per horsepower. Wing loading 19.5 pounds per square foot. Empty weight 21,300 pounds. Useful load 12,700 pounds. Payload 8695 pounds. Gross weight 34,000 pounds. Fuel capacity 1040 gallons. Oil capacity 80 gallons. Maximum speed 137 miles per hour. Cruising speed 117 miles per hour. Landing speed 65 miles per hour. Service ceiling 11,700 feet. Rate of climb 800 feet per minute. Cruising range 900 miles.

Hull: two-step type, short stern, 7 watertight compartments; metal structure, metal covered; deep keel, closely spaced transverse frames and light stringers; anchor compartment in bow, next aft pilots' compartment with provision for radio, third compartment contains 4 passenger-seats on port side removable for luggage space, rest room to starboard, fourth compartment accommodates 16 passenger-seats, fifth compartment has 8 passenger-seats, sixth compartment is smoking room with three chairs, stern compartment contains folding bunks for crew. Wing: conventional two-spar construction with compression strut and diagonal wire-bracing; metal construction, fabric covered. Tail group: horizontal surfaces and twin fins and rudders supported by two outriggers, connected to rear spar of wing and braced by two struts to hull sternpost; construction similar to wing. Fafnir bearings for plane and engine controls.

Standard equipment includes Exide battery, Pyle National landing and navigation lights, Pan American Airways radio, Hamilton Standard propellers. Instruments by Pioneer, Kollsman, Lewis, General Electric.

Also see data in September, 1931, Aero Digest.

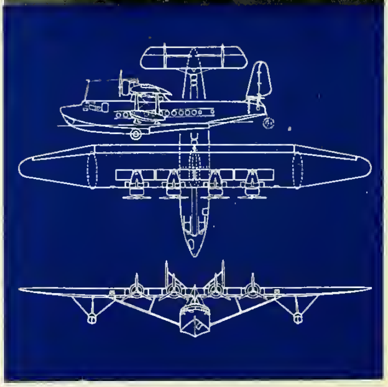
SIKORSKY S-42

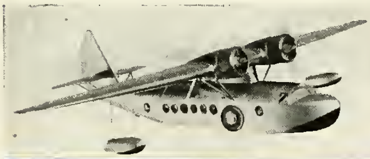
Sikorsky Aircraft Corporation, Bridgeport, Connecticut

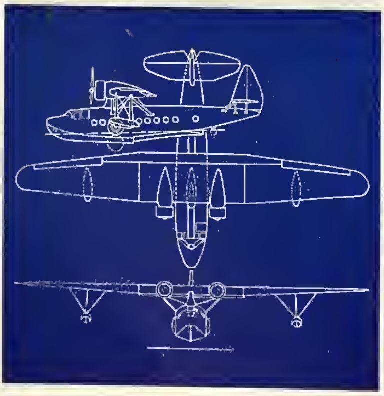
• Thirty-seven place high-wing seaplane. ATC 544. Four P. & W. S5D-1G Hornet engines, 700 horsepower each. Span 114 feet 2 inches. Length overall 67 feet 8 inches. Height overall 17 feet 4 inches. Wing area 1330 square feet. Power loading 13.57 pounds per horsepower. Wing loading 28.58 pounds per square foot. Empty weight 21,945 pounds. Useful load 16,055 pounds. Payload 8060 pounds. Gross weight 38,000 pounds. Fuel capacity 1240 gallons. Oil capacity 74 gallons. Maximum speed at sea level 180 miles per hour. Cruising speed at sea level 160 miles per hour. Landing speed 65 miles per hour. Service ceiling 16,000 feet. Rate of climb 1000 feet per minute. Cruising range 1200 miles.

Hull: two-step type, long stern, 9 watertight compartments; structure consists of deep keel, widely spaced transverse frames and heavy stringers; metal structure, metal covered; anchor compartment in bow, next aft pilots' compartment, third compartment for baggage and express, next four compartments accommodate 8 passengers each, rearward of last passenger compartment are 2 lavatories, the eighth compartment contains the main entrance and accommodations for the steward. Wing: two-spar construction; compression struts, and stressed-metal skin covering on both sides of wing forward of rear spar; rear of rear spar fabric covered; hydraulically-operated flap of metal structure, fabric covered; flush-rivetting all over. Tail group: metal construction, fabric covered; horizontal surfaces, twin fins and rudder supported by hull and side struts. Fafnir bearings for all controls.

Standard equipment includes Exide battery, Pyle National navigation lights, General Electric landing lights, Hamilton Standard controllable-pitch propellers. Instruments by Kollsman, Pioneer, Lewis, General Electric, Sperry, Eclipse.







SIKORSKY S-43

Sikorsky Aircraft Corporation, Bridgeport, Conn.

• Seventeen-place high-wing amphibion. Two P. & W. Hornet S1E-G engines, 750 horsepower each. Span 84 feet. Length overall 50 feet 5 inches. Height overall 17 feet 9 inches. Wing area 775 square feet. Chord 11 feet 6 inches. Power loading 11.7 pounds per horsepower. Wing loading 22.63 pounds per square foot. Empty weight 9821 pounds. Useful load 7720 pounds. Payload 4000 pounds. Gross weight 17,541 pounds. Fuel capacity 400 gallons. Oil capacity 24 gallons. Maximum speed at sea level 186 miles per hour. Cruising speed at sea level 167 miles per hour. Landing speed 65 miles per hour. Service ceiling 23,000 feet. Rate of climb 1275 feet per minute. Cruising range 750 miles.

Hull: two-step type, short stern with five watertight compartments; metal structure, metal covered; shallow keel, widely spaced transverse frames and bulkheads, and heavy stringers; contains anchor compartment in bow, pilot's compartment next aft with provision for radio, then baggage, steward's and toilet compartment, next a passenger compartment for ten passengers, aft of which is another passenger compartment for five passengers and the entrance and exit, through a hatch. Wing: monospar, single box type construction, metal; leading edge removable for inspection; center section is supported on tower and strut braced to hull and houses engines, tanks, controls, etc.; metal and fabric covering, flush riveting all over. Tail group: metal structure, fabric covered; adjustable stabilizer, dynamically balanced elevator; single rudder balanced by automatic trailing edge flap. Fully retractable landing gear equipped with Goodrich or General 45-inch streamline tire, Autofan wheels and brakes, Sikorsky shock absorbers. Fafnir and Norma-Hoffmann bearings on all controls.

Standard equipment includes Exide battery, Pyle National landing and navigation lights; Hamilton Standard controllable-pitch or constant speed propellers.

Instruments by Kollsman, Pioneer, Lewis, General Electric, Sperry, Eclipse.

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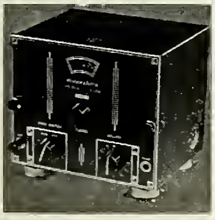

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SPARTAN Model C-5-301

Spartan Aircraft Company, Tulsa, Oklahoma

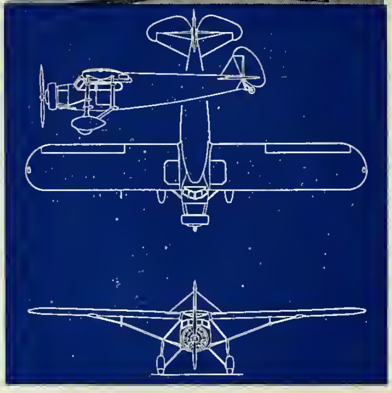
• Vice-president and General Manager: E. W. Hudlow. Chief Engineer: James B. Ford.

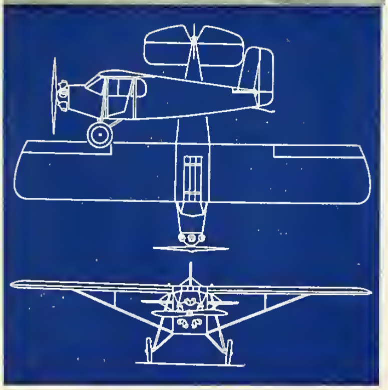
Four-place high-wing monoplane. Pratt and Whitney Wasp Junior engine, 320 horsepower. ATC 389. Span 50 feet. Length overall 32 feet 7.75 inches. Height overall 8 feet 11 inches. Wing area 299 square feet. Chord 80 inches. Power loading 13.04 pounds per horsepower. Wing loading 13.96 pounds per square foot. Empty weight 2632 pounds. Useful load 1543 pounds. Payload 805 pounds. Gross weight 4175 pounds. Fuel capacity 85 gallons. Oil capacity 7.75 gallons. Maximum speed 145 miles per hour. Cruising speed 124 miles per hour. Landing speed 57.5 miles per hour. Service ceiling 14,600 feet. Rate of climb 940 feet per minute. Cruising range 648 miles.

Fuselage: fabric covered; welded steel tube construction; double tandem seating arrangement. Wing: fabric covered; spars and ribs of spruce; attached to top fuselage longerons and are braced to the bottom of the fuselage by parallel steel tube struts; outer ends of bracing struts are anchored to a cross-braced structure of steel tubes; inner end of front strut is anchored to a steel tube pyramid on the side of the fuselage to which the main leg of the landing gear is also attached; main fuel tanks carried in the wings, one on either side of the fuselage. Tail group: fabric covered; adjustable stabilizer; spruce spars, metal ribs in fin; elevators and rudder have duralumin tube spars and duralumin ribs. Fixed divided-type landing gear equiped with 9.50 × 12 tires. Bendix wheels and brakes, Cleveland Pneumatic Aerol shock absorbers; swivel-type tail wheel equipped with pneumatic tires. Ball and plain bearing equipped.

Standard equipment includes navigation lights, Hamilton Standard metal propeller, Exide battery.

Instruments: altimeter, tachometer, air speed indicator, bank and turn indicator, oil pressure gauge, oil temperature gauge, compass, fuel gauge.





STAR Model E

Star Aircraft Company, Bartlesville, Oklahoma

• President: John H. Kane. Vice-president, General Manager and Sales Manager: Billy Parker. Chief Engineer: Charles Peters.

Two-place high-wing monoplane. ATC 321. Lambert R-266 engine, 90 horsepower. Span 31 feet. Length overall 20 feet 1 inch. Height overall 6 feet 8 inches. Wing area 142 square feet. Power loading 15.8 pounds per horsepower. Wing loading 10 pounds per square foot. Empty weight 919 pounds. Useful load 506 pounds. Payload 185 pounds. Gross weight 1425 pounds. Fuel capacity 22 gallons. Oil capacity 2.5 gallons. Maximum speed at 2300 r.p.m. 105 miles per hour. Cruising speed at 2000 r.p.m. 90 miles per hour. Landing speed 38 miles per hour. Service ceiling 16,000 feet. Rate of climb 750 feet per min. Cruising range 360 miles.

Fuselage: welded steel tube structure, fabric covered; side-by-side seating arrangement; single control column with extension for dual control provided; luggage compartment is behind the seats; windows in front and sides of cockpit, with the front windshield extending from the leading edge of the wing to the top of the fuselage. Wing: two solid I-section spruce spars; Warren truss spruce ribs; fabric covered; wings in two sections attached to two cross tubes welded across and above the fuselage longerons; braced by parallel steel tube struts to the bottom fuselage longerons; narrow chord ailerons. Tail group: welded steel tube framework, fabric covered; adjustable stabilizer. Fixed divided-type landing gear; top of shock struts anchored to top fuselage longerons with bottom ends hinged to bottom fuselage longerons by steel tube Vees; equipped with 26 × 5 tires, Bendix wheels and brakes, Warner shock absorbers.

Standard equipment includes Fahlin wood propeller.

Instruments: oil temperature gauge, oil pressure gauge, altimeter, tachometer.

STEARMAN Model 81

Stearman Aircraft Company, Wichita, Kansas

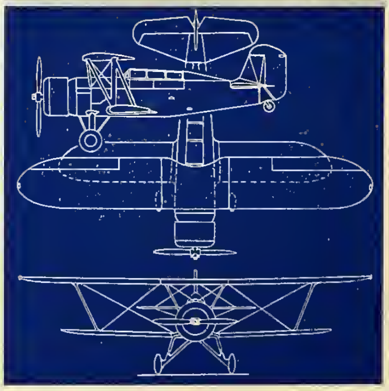
• President and General Manager: J. E. Schaeffer. Vice-president and Chief Engineer: Mac Short. Secretary-Treasurer: Clif Barron.

Two-place open biplane. ATC 504. P. & W. Wasp Junior engine, 420 horsepower. Span 35 feet. Length overall 25 feet 1 inch. Height overall 9 feet 4 inches. Wing area 275 square feet. Chord upper wing 62 inches. Chord lower wing 48 inches. Power loading 9.52 pounds per horsepower. Wing loading 14.53 pounds per square foot. Empty weight 2385 pounds. Useful load 1615 pounds. Payload 230 pounds. Gross weight 4000 pounds. Fuel capacity 155 gallons. Oil capacity 10 gallons. Maximum speed 170 miles per hour. Cruising speed at 87% power 140 miles per hour. Landing speed 60 miles per hour. Service ceiling 17,000 feet. Rate of climb 1100 feet per minute. Cruising range 1033 miles.

Fuselage: fabric covered chrome molybdenum welded steel tubing; fairing with plywood and spruce stringers; detachable engine mount; forward portion, as well as mail pit, metal cowled; tandem cockpits, dual controls. Wings: wood beams and ribs; metal compression members; steel fitting and steel interplane struts; single bay truss; wing cell of four panels and center section; ailerons on upper panels only. Tail group: steel tube structure, fabric covered; fixed stabilizer; balanced elevators with trimming tabs at trailing edges; fixed fin with balanced rudder and fixed trim tab. Wire braced split axle landing gear with General tires, Bendix wheels and brakes, spring oleo shock absorbers. Plane controls equipped with Fafnir ball bearings; engine controls plain and ball bearing.

Standard equipment includes Hamilton Standard controllable-pitch metal propeller, Exide battery, landing lights, illuminated instrument board.

Flight, engine and blind flying instruments are provided in both the front and rear cockpits, including tachometers, altimeters, air speed indicators.



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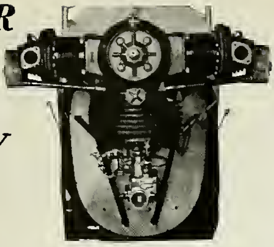

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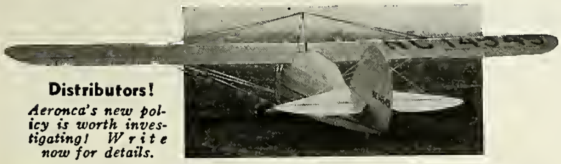

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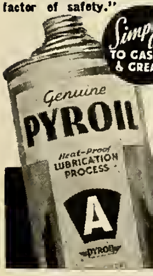

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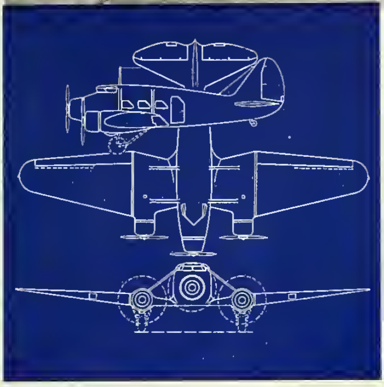
STINSON Model A Airliner

Stinson Aircraft Corporation, Wayne, Michigan



• President: B. D. DeWeese. Vice-president: W. A. Mara. Sales Manager: J. C. Kelley, Jr.

Ten-place low-wing monoplane. Three Lycoming R-680-5 engines, 260 horsepower each. Span 60 feet. Length overall 36 feet 10 inches. Height overall 12 feet 9 inches. Wing area 500 square feet. Power loading 12.9 pounds per horsepower. Wing loading 20.2 pounds per square foot. Weight empty 7020 pounds. Useful load 3080 pounds. Payload 1860 pounds. Gross weight 10,100 pounds. Fuel capacity 160 gallons. Oil capacity 12 gallons. Cruising speed at 5000 feet 163 miles per hour; cruising speed at 1000 feet 157 miles per hour. Rate of climb 1000 feet per minute. Range with 35% excess fuel is 350 miles.

Fuselage: chrome molybdenum steel tube framework, sheet metal covered on forward section, rear fabric; one all-metal fuselage baggage compartment and two all-metal nacelle compartments. Wing: in three sections; outer wings fabric covered; inner wings and nacelles, sheet-metal covered; stubs tapering in chord and thickness from outer ends to root are braced to the fuselage top by parallel struts; the outer wing sections taper in chord and thickness from roots to tips; flaps extend from engine nacelle to engine nacelle. Tail group: with steel tube frame, fabric covered; adjustable tabs in trailing edge of rudder and elevators. Retractable landing gear, electrically operated, equipped with hydraulic brakes with Bendix power booster.

Standard equipment includes landing lights, bonding and shielding, safety glass, lavatory. Extra equipment includes two-way radio, de-icers, dual controls, Lux fire extinguisher, vacuum pump. Flap and landing gear operation fully automatic.

Instruments: Sperry directional gyro, Sperry gyro-horizon, and complete set of blind flying instruments. Three Lycoming-Smith controllable-pitch metal propellers. Also see data in March, 1934, Aero Digest.

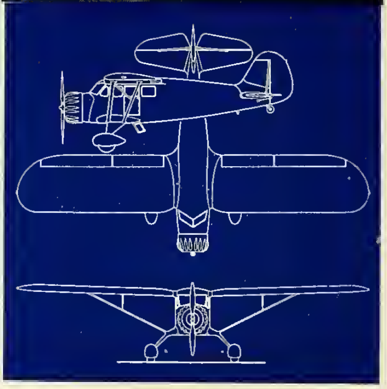
STINSON Reliant

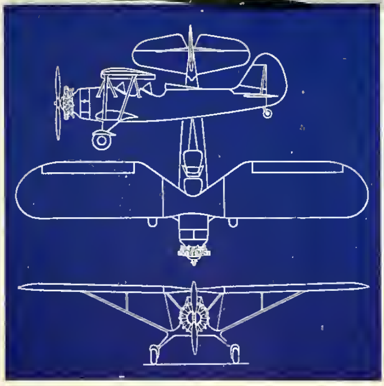
Stinson Aircraft Corporation, Wayne, Michigan

• Four-place high-wing monoplane. ATC 537. Lycoming R-680-4 engine, 225 horsepower. Span 41 feet. Length overall 26 feet 10 inches. Height overall 8 feet 5 inches. Wing area 230 square feet. Chord 80 inches. Power loading 14.8 pounds per horsepower. Wing loading 14.5 pounds per square foot. Weight empty 2250 pounds. Useful load 1075 pounds. Gross weight 3325 pounds. Fuel capacity 50 gallons. Oil capacity 4 gallons. Maximum speed 138 miles per hour. Cruising speed 122.8 miles per hour. Rate of climb 725 feet per minute. Service ceiling 14,500 feet. Range 350 miles.

Fuselage: welded steel tube structure, fabric covered. Wing: solid spruce spars; metal ribs, fabric covered; gulled Clark Y section; flaps are of metal construction installed at the trailing edge of the wings between the fuselage and ailerons. Tail group: welded chrome molybdenum steel tubing, fabric covered. Fixed divided type landing gear; each leg is hinged to stubs extending from the fuselage, and is equipped with oleo Aerol shock absorbers, streamlined pants, airwheels and hydraulic brakes.

Standard equipment includes "Selectiv-Glide" (Stinson Speed Arresters), rear vision mirror, optional landing gear fairing equipment. Two cabin doors, dual wheel control, adjustable pilots' seats, heat and ventilation controllable by the pilot, 12-volt storage battery, V-type windshield, roll-down safety glass windows, indirectly lighted instrument panel, Eclipse electric starter, Hamilton Standard variable-pitch propeller. When the Lycoming-Smith controllable-pitch propeller is used, gross and useful loads automatically increase 225 pounds. Instruments are mounted on rubber vibration dampeners. A baggage compartment, of ample size to hold bags and golf clubs, may be reached from both inside and outside of the cabin. When the outer door of the compartment is opened a light is automatically switched on.





STINSON Senior Trainer Model O

Stinson Aircraft Corporation, Wayne, Michigan

• Two-place open high-wing monoplane. Lycoming R-680-4 engine, 225 horsepower. Span 39 feet 11.5 inches. Length overall 27 feet 8 inches. Height overall 8 feet. Wing area 215 square feet. Power loading 11.75 pounds per horsepower. Wing loading 12.3 pounds per square foot. Empty weight 1945 pounds. Useful load 710 pounds. Variable payload. Normal gross weight 2655 pounds. Fuel capacity 50 gallons. Oil capacity 4 gallons. Maximum speed 136 miles per hour. Cruising speed 124 miles per hour. Landing speed 50 miles per hour. Rate of climb 1150 feet per minute. Cruising range 440 miles.

Fuselage: fabric covered; welded chrome molybdenum steel tubing; tandem seating arrangement, dual controls; parking brakes and individual foot brakes in front cockpit. Wing: fabric covered; spars spruce; ribs dural; cutaway center section mounted on splayed out struts carries the outer wing sections which are braced to the outrigger stubs which also form an anchorage for the landing gear. Tail group: fabric covered; welded steel tubing. Fixed cantilever landing gear equipped with 8.50 × 10 or 25 × 11 tires, Autofan or Goodyear wheels and brakes, Cleveland Pneumatic oleo shock absorbers; consists of 2 cantilever legs, each of which is built in one piece and consists of two bearings; wheel fenders over each unit; adaptable for twin float installation. Plane and engine controls ball bearing equipped; fully swivelling pneumatic tail wheel.

Standard equipment includes Hamilton Standard or Lycoming-Smith controllable-pitch propeller.

Instruments: bank and turn indicator, rate of climb indicator, altimeter, air speed indicator, oil pressure gauge, oil temperature gauge; rear cockpit contains altimeter, air speed indicator, tachometer, oil pressure gauge, oil temperature gauge.

Optional equipment: radio, flares, landing lights, navigation lights, hand inertia starter, rear exhaust collector ring, all-metal speed ring.

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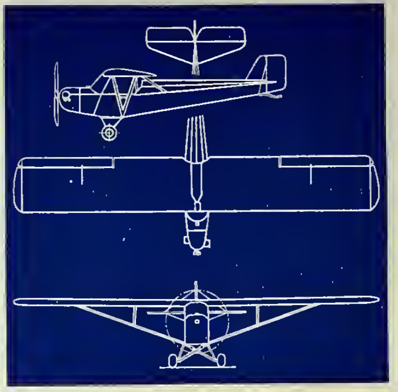
Two-place open or closed high-wing land monoplane. (Models E-2 and F-2 respectively; data on F-2 indicated in brackets.) ATC 455 (525). Continental A40-2 engine, 37 horsepower; (Aeromarine AR-3-40 engine, 40 horsepower). Span 35 feet 3 inches. Length overall 22 feet 3 inches; (22 feet). Height overall 6 feet 6 inches. Wing area 184 square feet. Power loading 25 (23.8) pounds per horsepower. Wing loading 5.06 (5.16) pounds per square foot. Weight empty 532 (538) pounds. Useful load 400 (412) pounds. Payload 170 (175) pounds. Gross weight 932 (950) pounds. Fuel capacity 9 gallons. Oil capacity 1 gallon. Maximum speed 85 (94) miles per hour. Cruising speed 70 (85) miles per hour. Landing speed 28 (30) miles per hour. Service ceiling 12,000 (14,000) feet. Rate of climb 450 (600) feet per minute. Cruising range 200 (175) miles.

Fuselage: welded steel tubing, Warren truss type, fabric covered. Removable engine mount. Pyralin windows. Wing: solid spruce spars, with ribs of riveted aluminum alloy drawn sections, fabric covered. Wings are supported above the fuselage by a system of steel tube struts, which forms the framework of the cockpit. Drag struts, steel tubing. Lift struts, streamlined steel tubing. Tail group: monoplane type; welded steel tubes and formed sections, cloth covered. Stabilizer adjustable in flight; fin adjustable. Fixed-type landing gear with Goodrich 7.00 × 4 tires; Shinn Devices Co. cast aluminum brakes; shock cord rings.

Instruments: tachometer, oil pressure gauge, oil temperature gauge, altimeter. Winter enclosure, special equipment. Sensenich Bros. wood propeller.



BURNELLI UB-14A

Burnelli Aircraft, Ltd., Keyport, New Jersey

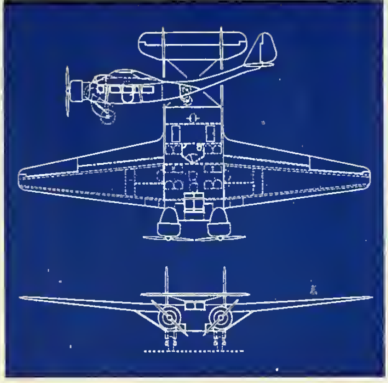
• President: I. M. Uppercu. Vice-president and General Manager: Vincent J. Burnelli. Sales Manager: H. R. Boyce. Chief Engineers: (Military division) Dr. Michael Watter; (Transport division) R. Contini.

Sixteen-place monoplane. Two P. & W. Hornet engines, 675 horsepower each. Span 71 feet 2.4 inches. Length overall 42 feet 8 inches. Height overall 10 feet. Wing area (including 168 square feet in fuselage) 686 square feet. Power loading 10.2 pounds per horsepower. Wing loading 20.4 pounds per square foot. Empty weight 8400 pounds. Useful load 5600 pounds. Payload 3400 pounds. Gross weight 14,000 pounds. Fuel capacity 270 gallons. Oil capacity 20 gallons. Maximum speed 225 miles per hour. Cruising speed 205 miles per hour. Landing speed 65 miles per hour. Service ceiling 19,000 feet. Rate of climb 1180 feet per minute. Cruising range 500 miles.

Fuselage: all-metal box type; longitudinal bending taken by extruded aluminum alloy longerons and auxiliary stringers; longitudinal shear taken by 24ST aluminum alloy sheet of light gauges; transverse loads taken by bulkheads of extruded aluminum alloy chord and vertical members and flap sheet shear web. Wing: all-metal; spars are tension field beams of extruded aluminum alloy chord members and verticals, and 24ST sheet light gauge webs; aluminum alloy truss type ribs; 24ST skin; riveted construction; torque-driven flaps are aluminum alloy skin, truss ribs. Tail group: all-metal. Fully retractable landing gear equipped with 42 × 15 Goodrich tires, Autofan wheels and brakes, oil and spring shock absorbers. Fafnir bearings for plane controls.

Standard equipment includes Hamilton Standard variable-pitch propellers, landing, and navigation lights.

All flight and engine instruments; Kollsman and Pioneer products including altimeters, compass, fuel and oil gauges, tachometers, air speed indicators.



KITTY HAWK B-8

Viking Flying Boat Company, New Haven, Connecticut

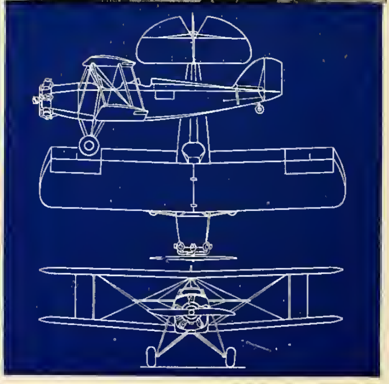
• President: Robert E. Gross. Vice-president, Treasurer and Sales Manager: Courtlandt S. Gross. General Manager and Assistant Treasurer: Jacob L. Freed. Chief Engineer: Franklin T. Kurt.

Three-place open biplane. ATC 392. Kinner B-5 engine, 125 horsepower. Span 28 feet 4 inches. Length overall 22 feet 11 inches. Height overall 8 feet 8 inches. Wing area 233.4 square feet. Chord 54 inches. Power loading 15.60 pounds per horsepower. Wing loading 8.37 pounds per square foot. Empty weight 1178 pounds. Useful load 772 pounds. Payload 383 pounds. Gross weight 1950 pounds. Fuel capacity 35 gallons. Oil capacity 3 gallons. Maximum speed 110 miles per hour. Cruising speed 90 miles per hour. Landing speed 42 miles per hour. Service ceiling 15,300 feet. Rate of climb 700 feet per minute. Cruising range 420 miles.

Fuselage: seamless steel tubing, welded joints, fabric covered, two seats forward, one aft; dual controls; baggage compartment aft of rear cockpit. Wings: wood and fabric construction, spars and ribs of spruce; wings divided into 2 panels with 4 drag bays in each; lower wing bolted to fuselage, upper wings connected by cabane struts; cabane fitting designed to permit deflection of spars without setting up bending stresses in cabane members; narrow chord ailerons on top and bottom wings; interplane struts and cabane members of streamline tubing. Tail group: welded seamless tubing, fabric covered; adjustable stabilizer; fin and stabilizer braced to fuselage with double tie rods and streamline tubes. Fixed split-type landing gear equipped with Warner Aircraft Corporation wheels and brakes and oleo shock absorbers consists of two telescopic legs with top ends anchored to bottom fuselage longerons.

Standard equipment includes navigation lights, steerable tail wheel, Hartzell wood propeller.

Instruments: primer, fuel gauge, Pioneer compass, air speed indicator, tachometer, altimeter, oil pressure gauge.



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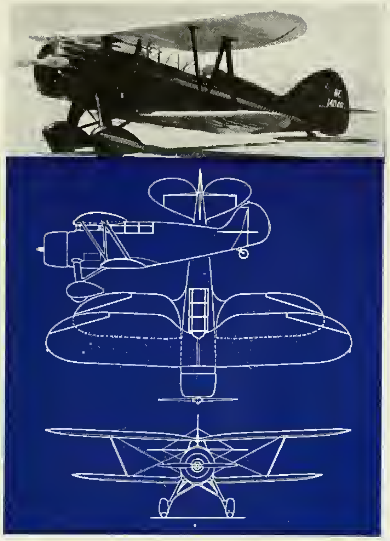


WACO Model S3HD

Waco Aircraft Company, Troy, Ohio

• President and General Manager: C. H. Brukner. Vice-president: Lee N. Brutus. Sales Manager: Hugh R. Perry. Chief Engineer: A. F. Arcier.

Two-place open-or-closed biplane. P. & W. Wasp Junior engine, 420 horsepower. ATC 543. Span 32 feet 8.62 inches. Length overall 25 feet .5 inch. Height overall 8 feet 11.5 inches. Wing area 256.3 square feet. Power loading 9.05 pounds per horsepower. Wing loading 14.84 pounds per square foot. Empty weight 2435 pounds. Useful load 965 pounds. Payload 202 pounds. Gross weight 3400 pounds. Fuel capacity 90 gallons. Oil capacity 6 gallons. Maximum speed 196 miles per hour. Cruising speed 170 miles per hour. Landing speed 60 miles per hour. Service ceiling 20,000 feet. Rate of climb 1600 feet per minute. Cruising range 600 miles.

Fuselage: fabric covered; chrome molybdenum welded steel tubing; tandem seating arrangement with dual controls; coupé top for each cockpit; baggage compartment aft of rear seat. Wings: fabric covered; spars spruce; ribs spruce and plywood; external bracing by streamlined wires; *N*-type interplane struts. Tail group: fabric covered; wood spars; metal ribs in fin and stabilizer; metal tubing in rudder and elevators; adjustable stabilizer. Fixed divided-type landing gear equipped with wheel pants, 8.50 × 10 tires, Autofan wheels and brakes, oleo shock absorbers; equipped with swivelling tail wheel.

Standard equipment includes Hamilton Standard controllable-pitch propeller, Exide battery, electric starter, generator, landing lights, flares, bonding and shielding, Lear, Westport or RCA radio receiver, indirectly lighted instrument board.

Instruments: air speed indicator, altimeter, tachometer, compass, oil pressure gauge, oil temperature gauge, fuel pressure gauge, bank and turn indicator, rate of climb indicator, thermocouple, voltmeter, Pioneer clock.

WACO Models UKC, YKC, CJC

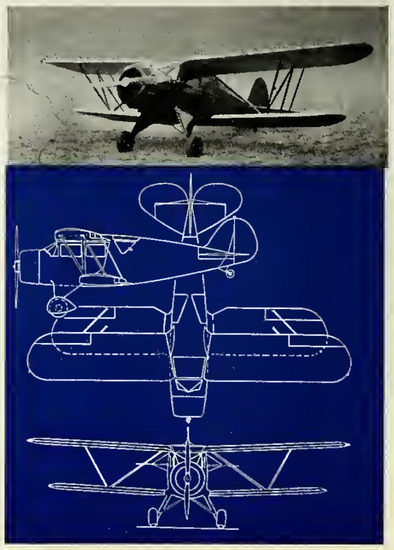
Waco Aircraft Company, Troy, Ohio

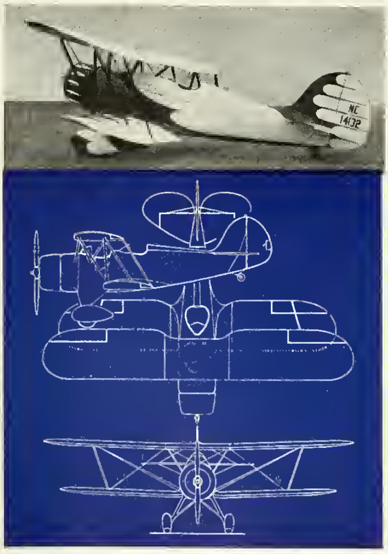
• Four-place biplane. (Models UKC, YKC, and CJC respectively; data on CJC indicated in brackets and on YKC following brackets in that order.) Continental engine, 210 horsepower (Wright Whirlwind engine, 250 horsepower) Jacobs engine 225 horsepower. ATC 528 (538) 533. Span 33 ft. 2.62 in. (34 ft. 10 in.) 33 ft. 2.62 in. Length overall 25 ft. 2.5 in. (25 ft. 8 in.) 25 ft. 2.5 in. Height overall 8 ft. 6 in. (8 ft. 9.5 in.) 8 ft. 6 in. Wing area 240 (264) 240 sq. ft. Power loading 14.3 (12.8) 13.3 lb./h.p. Wing loading 12.5 (12.1) 12.5 lbs./sq. ft. Empty weight 1720 (1941) 1773 lbs. Useful load 1280 (1359) 1227 lbs. Payload 780 (631) 727 lbs. Gross weight 3000 (3200) 3000 lbs. Fuel capacity 50 (70) 50 gal. Oil capacity 4 (5) 4 gal. Maximum speed 138 (147) 143 m.p.h. Cruising speed 123 (129) 125 m.p.h. Landing speed 53 (52) 53 m.p.h. Service ceiling 13,000 (16,000) 15,000 ft. Rate of climb 750 (850) 800 ft./min. Cruising range 430 (580) 430 miles.

Fuselage: fabric covered; chrome molybdenum welded steel tubing; tandem seating arrangement, in pairs, with dual controls; windows provided at rear of cabin on top and sides with sloping windshield forward and two triangular windows aft of cabin. Wings: fabric covered; spars spruce; ribs spruce and plywood; metal framed and covered ailerons on all wings; top wings hinged to top fuselage longerons. Tail group: fabric covered; chrome molybdenum welded steel tubing; adjustable stabilizer. Fixed divided-type landing gear equipped with 7.50 × 10 tires, Autofan wheels and brakes, oleo shock absorbers; adaptable for float installation.

Standard equipment includes Exide battery, Hartzell wood propeller, electric starter, navigation lights, NACA cowling.

Instruments: tachometer, altimeter, compass, air speed indicator, oil pressure gauge, oil temperature gauge.





WACO Models UMF and YMF

Waco Aircraft Company, Troy, Ohio

• Three-place open biplane. (Models UMF and YMF respectively; data on YMF indicated in brackets.) Continental engine 210 horsepower. (Jacobs engine 225 horsepower.) ATC 546 (542). Span 30 feet. Length overall 23 feet 3.62 inches. Height overall 8 feet 5.37 inches. Wing area 233.5 square feet. Power loading 11.9 (11.1) pounds per horsepower. Wing loading 10.7 pounds per square foot. Empty weight 1485 (1540) pounds. Useful load 1015 (960 pounds). Payload 515 (460) pounds. Gross weight 2500 pounds. Fuel capacity 50 gallons. Oil capacity 4 gallons. Maximum speed 143 (147) miles per hour. Cruising speed 128 (129) miles per hour. Landing speed 47 miles per hour. Service ceiling 14,500 (16,000) feet. Rate of climb 1100 (1250) feet per minute. Cruising range 450 miles.

Fuselage: fabric covered; chrome molybdenum welded steel tubing; tandem seating arrangement, with two seats side-by-side in front; dual controls; baggage compartment. Wings: fabric covered; spars spruce; ribs spruce and plywood; center section carried above fuselage on splayed out *N*-struts, with *N*-strut interplane bracing; ailerons on all wings. Tail group: fabric covered; chrome molybdenum welded steel tubing; adjustable stabilizer. Fixed divided-type landing gear equipped with 7.50 × 10 tires, Autofan wheels and brakes, oleo shock absorbers; consists of two oleo compression members attached at their upper ends to two short strut-braced horizontal tubes, one on either side of the fuselage, and hinged at their bottom ends to the center line of the underside of the fuselage; equipped with tail wheel.

Standard equipment includes electric starter, Hartzell wood propeller, navigation lights, fire extinguisher, and NACA engine cowling.

Instruments: tachometer, altimeter, compass, air speed indicator, oil pressure gauge, oil temperature gauge.

WACO Models UOC, YOC, CUC

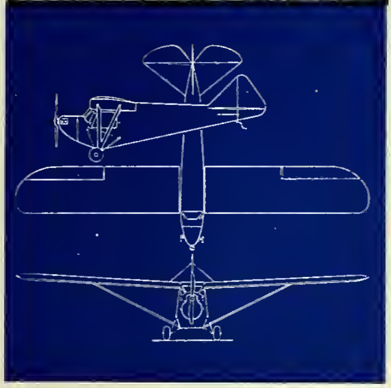
Waco Aircraft Company, Troy, Ohio

• Four-place biplane. (Models UOC, YOC, and CUC respectively; data on YOC indicated in brackets, and on CUC following brackets in that order.) Continental engine, 210 horsepower (Jacobs engine, 225 horsepower) Wright engine, 250 horsepower. Span 35 feet. Length overall 25 feet 4 inches (25 feet 6 inches) 25 feet 3 inches. Height overall 8 feet 1 inch. Wing area 238.8 square feet. Power loading 14.76 (13.78) 12.8 pounds per horsepower. Wing loading 12.9 (12.9) 13.4 pounds per square foot. Empty weight 1880 (1900) 1990 pounds. Useful load 1220 (1200) 1210 pounds. Payload 720 (700) 582 pounds. Gross weight 3100 (3100) 3200 pounds. Fuel capacity 50 (50) 70 gallons. Oil capacity 4 (4) 5 gallons. Maximum speed 151 (155) 162 miles per hour. Cruising speed 133 (137) 145 miles per hour. Landing speed without flaps 53 (53) 55 miles per hour. Service ceiling 15,300 (16,300) 17,000 feet. Rate of climb 920 (1000) 1070 feet per minute.

Fuselage: fabric covered; chrome molybdenum welded steel tubing; tandem seating arrangement in pairs, with dual throw-over wheel control column. Wings: fabric covered; spars spruce; ribs spruce and plywood. Tail group: fabric covered; wood spars; metal ribs in fin and stabilizer; metal tubing in rudder and elevators; adjustable stabilizer; tab on aileron; flaps. Fixed divided-type landing gear equipped with 7.50 × 10 tires, Autofan wheels and brakes, oleo shock absorbers; consists of two faired side Vees with cross bracing between front legs; equipped with tail wheel adaptable for installation of floats.

Standard equipment includes electric starter, navigation lights, fire extinguisher, indirectly lighted instrument panel, Hartzell wood propeller, Exide battery.

Instruments: tachometer, altimeter, compass, air speed indicator, oil pressure gauge, oil temperature gauge, fuel gauge. Photographs and drawings of these models were not available at the time this issue of AERO DIGEST went to press.



WELCH Models OW5M and OW7M

Orin Welch Aviation School, Anderson, Indiana

• President and Chief Engineer: Orin Welch. Sales Manager: John Welch.

One- or two-place open or closed monoplane. (Models OW5M and OW7M respectively; data on OW7M indicated in brackets.) Continental A-40 engine, 37 horsepower (Welch 0-2 engine, 45 horsepower). Approval number 2-474. Also available with Szekely engine, 45 horsepower; Salmson AD-9 engine, or Aeronca 113A engines. Span 34 feet 4 inches. Length overall 21 feet. Height overall 5 feet 8 inches. Wing area 136 square feet. 26.5 pounds per horsepower. Chord 54 inches. Wing loading 6.6 pounds per square foot. Empty weight 540 pounds. Useful load 394 pounds. Payload 170 pounds. Gross weight 950 pounds. Fuel capacity 8 gallons. Oil capacity 1 gallon. Maximum speed 93 miles per hour. Cruising speed 85 miles per hour. Landing speed 29 miles per hour. Service ceiling 11,000 feet. Rate of climb 450 ft./min. Cruising range 200 miles.

Fuselage: steel tubing, with fabric covering; three longerons, one longeron on the bottom extending back from cabin; seating arrangement in two place models are side-by-side; single control stick; manufactured in both open and closed models. Wing: fabric covered; spars are built up from two-play spruce web with spruce cap strips; ribs are of basswood; dural drag struts are used with drag wires; large diameter chrome molybdenum strut wing bracing converging at a large fitting on the fuselage, which is also used to secure the top axle fitting. Tail group: chrome molybdenum steel tubing; wire bracing, adjustable by placing a bolt in one of a series of holes in a plate fitting at the front of stabilizer. Fixed type landing gear equipped with 16 × 7.3 airwheels, no brakes. Controls are operated by cable on plain bearing.

Standard equipment includes Flottorp propeller and an ignition switch.

REARWIN Junior 4000

Rearwin Airplanes, Incorporated, Fairfax Airport, Kansas City, Kansas

• Two-place open or closed high-wing monoplane. ATC 469. Aeromarine engine, 50 horsepower. Span 36 feet. Length 21 feet 8 inches. Height 7 feet 3 inches. Wing area 179 square feet. Power loading 21.3 pounds per horsepower. Wing loading 5.95 pounds per square foot. Empty weight 635 pounds. Useful load 430 pounds. Payload 180 pounds. Gross weight 1065 pounds. Fuel capacity 12 gallons. Oil capacity 1.5 gallons. Maximum speed 92 miles per hour. Cruising speed 80 miles per hour. Landing speed 30 miles per hour. Rate of climb 600 feet per minute. Cruising range 240 miles.

Fuselage: welded chrome molybdenum steel tubing, fabric covered; one large cockpit, with two seats in tandem; individual windshields, or a transparent coupé covering for the entire cockpit may be provided; easily removable dual controls are provided. Wings: wood construction, fabric covered; two laminated spruce spars, spruce and plywood ribs; leading edge is plywood covered; center section is carried above the fuselage by struts, and outer sections are braced to the bottom fuselage longerons by parallel steel tubes. Tail group: chrome molybdenum streamlined steel tubing, fabric covered; adjustable stabilizer. Fixed split-type landing gear consisting of two side Vees, with half-axles hinged to the apex of Vee cabane under fuselage; equipped with 7.00 × 4 tires, Rusco ring shock absorbers. Tail skid of conventional shock-absorbing type.

Standard equipment includes Aeromarine wood propeller, and an ignition switch.

Instruments: tachometer, altimeter, oil temperature gauge, oil pressure gauge.

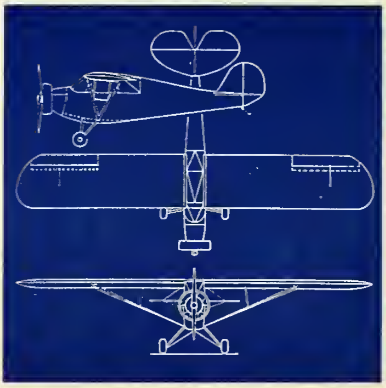
REARWIN Sportster 7000

Rearwin Airplanes, Incorporated, Fairfax Airport, Kansas City, Kansas

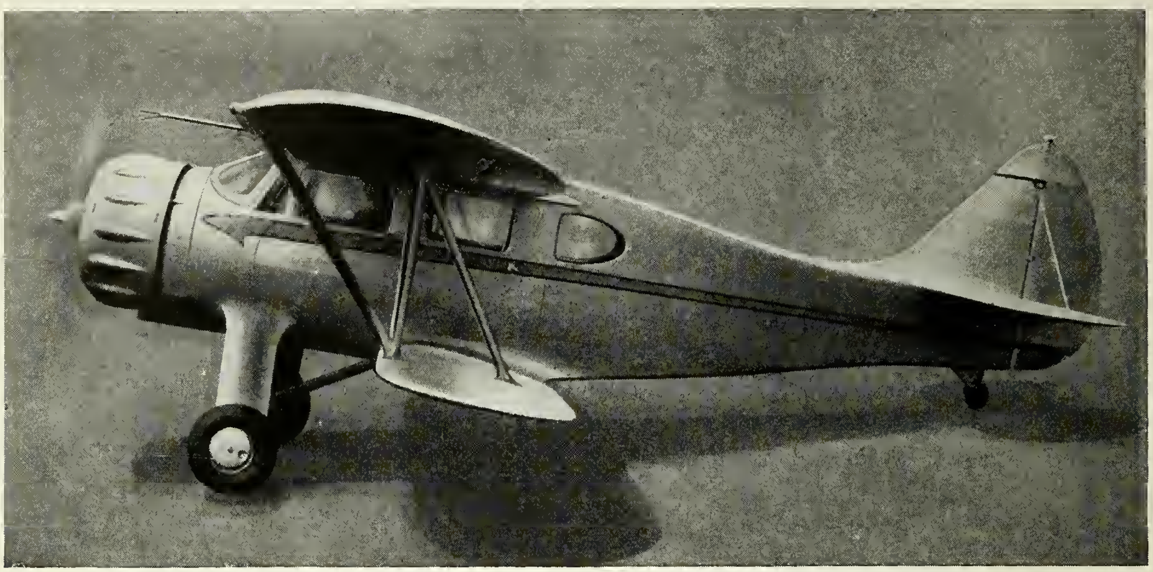
• Two-place high-wing monoplane. ATC 469. LeBlond engine, 70 horsepower. Span 35 feet. Length overall 22 feet 3 inches. Height overall 6 feet 9 inches. Wing area 166 square feet. Chord 62.5 inches. Power loading 18 pounds per horsepower. Wing loading 8.13 pounds per square foot. Empty weight 780 pounds. Useful load 570 pounds. Payload 220 pounds. Gross weight 1350 pounds. Fuel capacity 24 gallons. Oil capacity 2 gallons. Maximum speed 110 miles per hour. Cruising speed 100 miles per hour. Landing speed 35 miles per hour. Rate of climb 700 feet per minute. Cruising range 400 miles.

Fuselage: welded steel tube chrome molybdenum structure, fabric covered; tandem seating arrangement. Wings: wood construction, fabric covered, spruce spars, ribs.

Illustration not available for publication.



Again Waco writes Air History



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The Custom Cabin WACO is offered with the following power plants and cruising speeds—Continental, 133 miles; Jacobs, 137 miles; Wright, 145 miles; all based on 1900 R.P.M. Detailed performance figures will be supplied through any WACO dealer or sent to you direct upon request.

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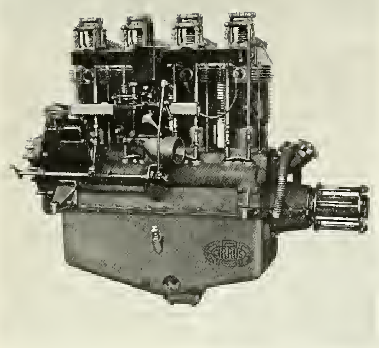


A.C.E. Cirrus Upright Mark III

The A.C.E. Corporation, Marysville, Michigan

• President, Vice-president and General Manager: J. G. Sterling. Sales Manager: Walter E. Berger.

Four-cylinder, in-line, direct-drive, air-cooled. Rated by the Department of Commerce 90 horsepower at 2100 revolutions per minute, using 70 octane fuel. ATC 30. Wet sump, pressure feed lubrication. Compression ratio 5.4:1. Bore 4.33 inches. Stroke 5.125 inches. Displacement 302 cubic inches. Length overall 46.5 inches. Height overall 37 inches. Width overall 17 inches. Bare weight 275 pounds. Weight in lbs./h.p. at sea level 2.75. Fuel consumption .54 lb./b.h.p./hr. Oil consumption .0213 lb./b.h.p./hr.

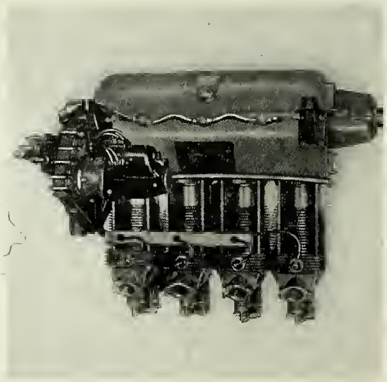
Construction: Crankshaft four throw type of hollow construction, SKF roller main, front and rear roller bearings, SKF ball for thrust bearing. Crankcase aluminum alloy casting divided along center line of shaft, both sections bolted together. Pistons aluminum alloy castings with three compression rings to each cylinder, hollow full floating piston pin. Cylinder heads aluminum alloy with fins cast integral, bronze seats for exhaust and inlet valves shrunk and expanded into position, bronze alloy valve guides force-fitted into heads. Cylinder barrels cast iron bolted into heads. One intake and exhaust nickel steel valve to each cylinder, operated by rocker arms which are actuated by push rods in conjunction with tappet rods in the upper part of crankcase.

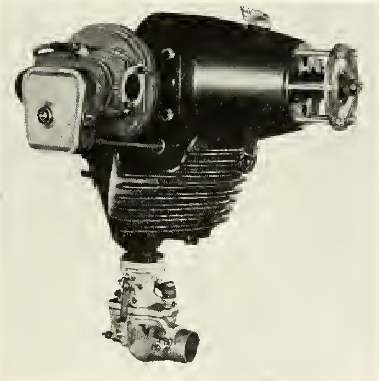
A.C.E. Hi-Drive Mark III

The A. C. E. Corporation, Marysville, Michigan

• Four-cylinder, inverted in-line, direct-drive, air-cooled. Rated by the Department of Commerce 95 horsepower at 2100 revolutions per minute using 72 octane fuel. ATC 60. Dry sump, pressure feed lubrication to main and connecting rod bearings. Compression ratio 5.4:1. Bore 4.33 inches. Stroke 5.125 inches. Displacement 302 cubic inches. Length overall 46.5 inches. Height overall 37 inches. Width overall 17 inches. Bare weight 272 pounds. Weight in lbs./h.p. at sea level 2.9. Fuel consumption .54 lb./b.h.p./hr. Oil consumption .0213 lb./b.h.p./hr.

Construction: Crankshaft four throw type of hollow construction, SKF roller main, front and rear bearings, SKF ball thrust bearing. Crankcase aluminum alloy casting divided along center line of shaft, both sections bolted together. Connecting rods dural forging of H-section, cap of big end attached to rod by two bolts and babbitt-lined big ends are fitted bearings. Pistons aluminum alloy castings with three compression and one oil ring to each cylinder, hollow full floating piston pin. Cylinder heads aluminum alloy bolted to cast-iron cylinder barrel by four long bolts to the crankcase, fins integral, valve seats phosphor bronze shrunk into head, guides force-fitted into heads. One intake and exhaust nickel steel valve to each cylinder, operated by rocker arms which are actuated by push rods in conjunction with tappet rods in the upper part of the crankcase.





AERONCA E-113B

Aeronautical Corporation of America, Cincinnati, Ohio

• President: Taylor Stanley. Vice-President: H. V. Fetick, General Manager: C. S. McKenzie, Jr. Sales Manager: J. C. Welsch. Chief Engineer: Roger E. Schlemmer. Export representatives: Howard T. Byler, Rio de Janeiro, Brazil. Strachan & MacMurray, Iloilo, Philippine Islands.

Two-cylinder, horizontally opposed, direct-drive, air-cooled. Rated by the manufacturer at 40 h.p. at 2500 r.p.m.; by the Department of Commerce at 36 h.p. at 2400 r.p.m. ATC 71. Pressure feed lubrication to connecting rod bearings; splash feed to balance of engine; major bearings anti-friction. Compression ratio 5:4. Bore 4.25 in. Stroke 4 in. Displacement 113.5 cu. in. Length overall 24.125 in. Height overall 26 in. Width overall 34.5 in. Fuel consumption .55 lb./b.h.p./hr. Oil consumption .25 pt./hr. Octane fuel rating 73.

Construction: Crankshaft 5% nickel steel forging, counterbalanced. Crankcase heat treated "B" alloy. Ball bearings for thrust, rocker arm, camshaft; roller bearings on crankshaft; needle roller bearings on crankpin connecting rods. Piston Permite aluminum alloy, three rings to each cylinder, one oil, two compression. Cylinder heads heat treated Y alloy castings. Cylinder barrels heat treated steel forgings. Aluminum Industries exhaust and intake valves.

Accessories: Bosch magneto, Zenith carburetor, B. G. spark plugs, Cuno oil filter, screen air filter, automatic spark control.

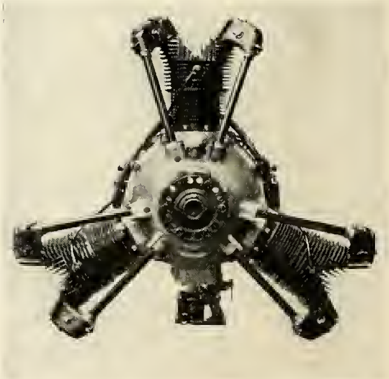
AEROMARINE AR-3 and AR-340

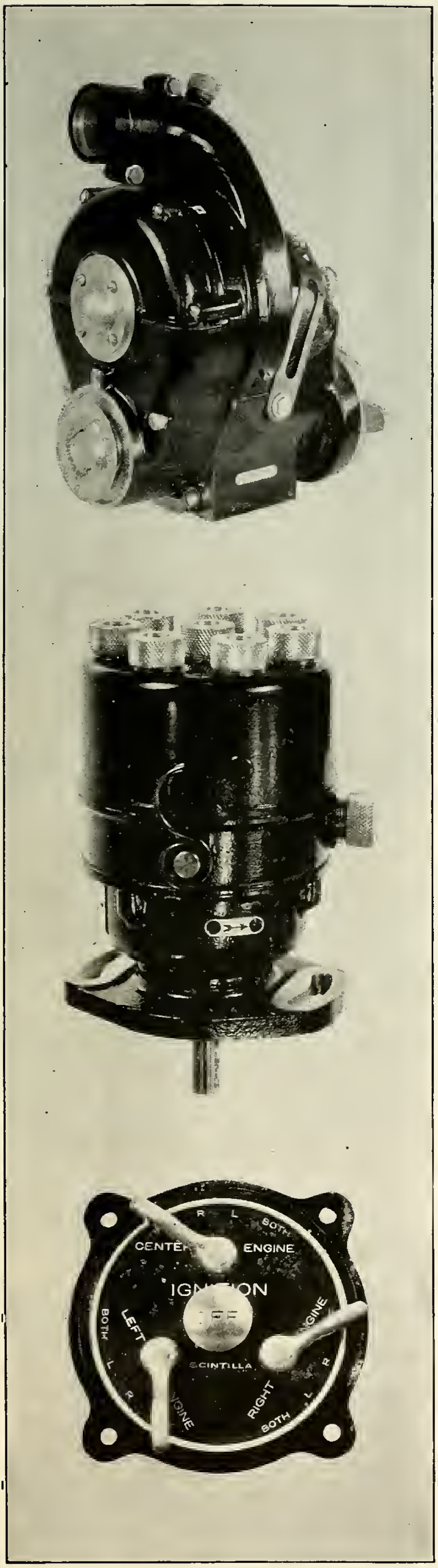
Burnelli Aircraft, Ltd., Motor Division, Keyport, New Jersey

• President: I. M. Uppercu. Vice-president: V. J. Burnelli. Secretary: F. W. Barker. Treasurer: H. Belanger.

Three cylinder, radial, direct-drive, air-cooled. (Models AR-3 and AR-340 respectively; data on AR-340 indicated in brackets). Rated by the Department of Commerce 50 (40) h.p. at 2100 (2050) r.p.m. ATC 74 (119). Gear pump lubrication. Compression ratio 5:1. Bore 4.125 inches. Stroke 4 inches. Displacement 160 cubic inches. Length overall (less starter) 23.93 inches. Diameter overall 34.25 inches. Weight without hub and with two magnetos 150 pounds. Weight in pounds per horsepower 3 (3.75). Fuel consumption at cruising r.p.m. 2.5-3.75 gallons per hour. Oil consumption at cruising r.p.m. .75 pint per hour.

Construction: Crankshaft two piece type of 3140 steel running in one babbitt lined bearing and three ball bearings with thrust taken in either direction by the forward ball bearing which is of the deep groove type. Crankcase, aluminum alloy casting in two sections divided at the cylinders with cam drive and thrust bearing in the forward half and intake manifold in the rear half. Pistons, aluminum, ribbed inside and cast in permanent mold with four piston rings to each cylinder, 2 compression and 2 oil. Cylinders are composite construction with heat treated aluminum alloy heads threaded and shrunk on forged steel heat treated and machined barrels having integral cooling and base flanges.





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SCINTILLA MAGNETO CO., INC.

(Subsidiary of Bendix Aviation Corporation)

SIDNEY, N. Y.

CONTINENTAL A-40

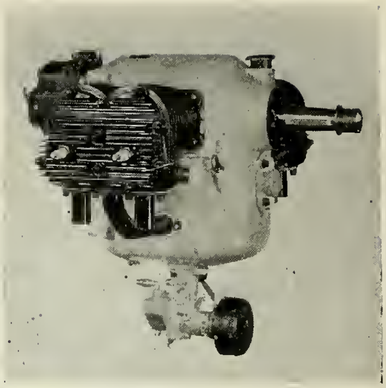
Continental Aircraft Engine Company, Detroit, Michigan

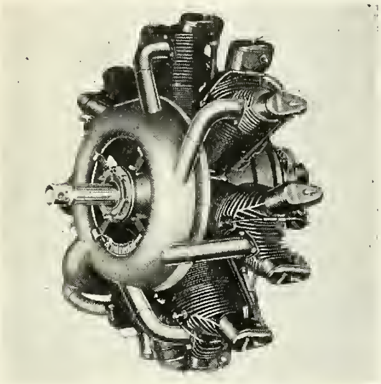
• President and General Manager: W. R. Angell. Vice-president: Roger Sherman. Sales Manager: Ray A. Long. Chief Engineer: N. N. Tilley.

Four-cylinder, horizontally opposed, direct-drive, air-cooled. Rated by the manufacturer at 40 h.p.; by the Department of Commerce at 37 h.p. at 2550 r.p.m. ATC 72. Wet sump lubrication, pressure feed to crankshaft and camshaft bearings. Compression ratio 5.2:1. Bore 3.125 in. Stroke 3.75 in. Displacement 115 cu. in. Length overall 27.31 in. Height overall 19.44 in. Width overall 28 in. Bare weight (with magneto and carburetor) 144 lbs. Weight per h.p. at sea level 3.9 lbs. Fuel consumption .75 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr.

Construction: Crankshaft steel forging machined all over, one piece, three-throw. Crankcase cast aluminum alloy, one piece, heavily ribbed within for strength. Plain bearings. Pistons cast aluminum alloy, trunk type, three compression, one oil ring above gudgeon pin, gudgeon pins floating, located by aluminum buttons. Cylinder heads cast aluminum alloy, L-type, attached to cylinder by nickel alloy steel studs and nuts. Cylinder barrels cast iron, each block attached to crankcase by six studs and nuts. One intake and one exhaust valve per cylinder.

Accessories: Scintilla PN4D, F1 or Bosch FF4A magneto, Stromberg NAS2 carburetor, B. G. 4B2 spark plugs.





CONTINENTAL R-670-E and R-670-G

Continental Aircraft Engine Company, Detroit, Michigan

• Seven-cylinder, radial, direct-drive, air-cooled. Rated by the manufacturer 215-220 horsepower; by the Department of Commerce at 210 horsepower at 2000 revolutions per minute. ATC 80. Both models identical except R-670-G has front exhaust cylinder head and R-670-E has rear exhaust cylinder head. Dry sump, full pressure lubrication to all bearings. Compression ratio 5.4:1. Bore 5.125 inches. Stroke 4.625 inches. Displacement 668 cubic inches. Length overall without generator and starter 32.625 inches. Diameter overall 42.5 inches. Bare weight with magnetos and carburetor 425 pounds. Weight per horsepower at sea level 2 pounds. Fuel consumption .55 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr.

Construction: Crankshaft two-piece clamp type, steel forged, machined all over, mounted on ball bearings. Crankcase cast heat treated aluminum alloy, in two sections, split at cylinder centerline. Pistons forged aluminum alloy, full skirt; four rings per cylinder, one oil, three compression. Cylinder heads heat treated cast aluminum. Cylinder barrels, forged steel, machined all over, screwed and shrunk into heads. Tulip-type valves, one stainless intake, one sodium filled exhaust per cylinder.

Accessories: Scintilla MN7DF magnetos, Stromberg NAR6 carburetor, B.G. 4B2 spark plugs. Optional equipment includes battery ignition radio shielding, fuel pump, oil filter, thermocouples, starter.

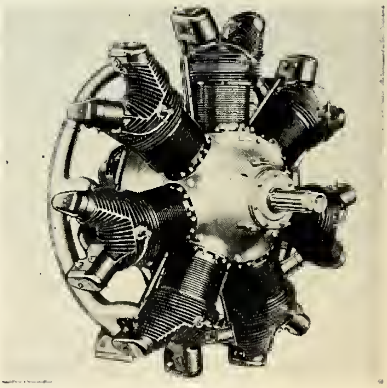
CONTINENTAL R-670-F and R-670-H

Continental Aircraft Engine Company, Detroit, Michigan

• Seven-cylinder, radial, direct-drive, air cooled. Rated by the manufacturer 230 horsepower; by the Department of Commerce at 225 horsepower at 2000 revolutions per minute. ATC 120. Both models identical except R-670-F has front exhaust cylinder head and R-670-H has rear exhaust cylinder head. Dry sump, full pressure lubrication to all bearings. Compression ratio 6.1:1. Bore 5.125 inches. Stroke 4.625 inches. Displacement 668 cubic inches. Length overall without generator and starter 32.625 inches. Diameter overall 42.5 inches. Bare weight with magnetos and carburetor 425 pounds. Weight per horsepower at sea level 2 pounds. Fuel consumption .55 pound per brake horsepower per hour. Oil consumption .025 lb./b.h.p./hr.

Construction: Crankshaft two-piece clamp type, steel forged, machined all over, mounted on ball bearings. Crankcase cast heat treated aluminum alloy, in two sections, split at cylinder centerline. Pistons forged aluminum alloy, full skirt; four rings per cylinder, one oil, three compression. Cylinder heads heat treated cast aluminum. Cylinder barrels, forged steel, machined all over, screwed and shrunk into head. Tulip-type valves, one stainless intake, one sodium filled exhaust valve per cylinder.

Accessories: Scintilla MN7DF magnetos. Stromberg NAR6 carburetor, B.G. 4B2 spark plugs. Radio shielding, fuel pump, oil filter, optional.



JACOBS L-4

Jacobs Aircraft Engine Company, Pottstown, Pennsylvania

• President: J. Story Smith. Vice-president and Chief Engineer: A. R. Jacobs. Vice-president in charge of production: H. M. McFadgen.

Seven-cylinder, radial, direct-drive, air-cooled. Model L-4 battery ignition; Models L-4M and L-4MA magneto ignition. Overall length of L-4 39.37 in., bare weight 415-420 lbs., and weight in lbs./h.p. 1.85; overall length of L-4M and L-4MA 40.19 in., bare weight 440-445 lbs., and weight in lbs./h.p. 1.96. L-4MA adapted for autogiro rotor drive. Engines identical otherwise. Rated by the Department of Commerce at 225 h.p. at 2000 r.p.m. ATC 121. Pressure lubrication, one pressure and one scavenging pump. Compression ratio 5.375:1. Bore 5.25 in. Stroke 5 in. Displacement 757 cu. in. Diameter overall 43.5 in. Fuel consumption at rated h.p. .5 to .55 lb./b.h.p./hr. Oil consumption at rated h.p. .018 lb./b.h.p./hr.

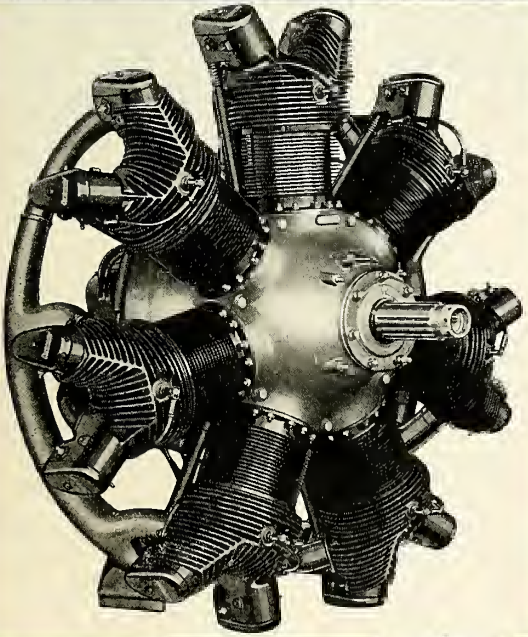
Construction: Crankshaft chrome nickel moly, two piece, clamp-type, machined and ground all over. Crankcase cast aluminum barrel-type, nose case and L-4 accessory case magnesium alloy castings. Pistons forged aluminum, trunk-type with three U. S. Hammered compression and one oil ring to each cylinder. Cylinder heads cast aluminum screwed and shrunk on chrome moly steel barrels. Marlin Rockwell ball bearings.

Accessories: Bosch timer distributors with L-4, Scintilla magnetos with L-4M and L-4MA.

A Great Name in AVIATION

Continental

Aircraft ENGINES



Continental's finely equipped laboratory assures rigid metallurgical inspection of all materials.

Large factors of safety have been used for rugged design to insure long life.

The finest tool and production facilities plus experienced personnel guarantee the highest standards of quality. The results justify the care behind the product as these engines are smooth in operation, constantly dependable and unusually long lived.

Available with exhaust directed to the front or rear—other progressive improvements include sodium cooled valves and forged aluminum alloy pistons.

CONTINENTAL AIRCRAFT ENGINE COMPANY
General Office and Factory, Detroit, Michigan

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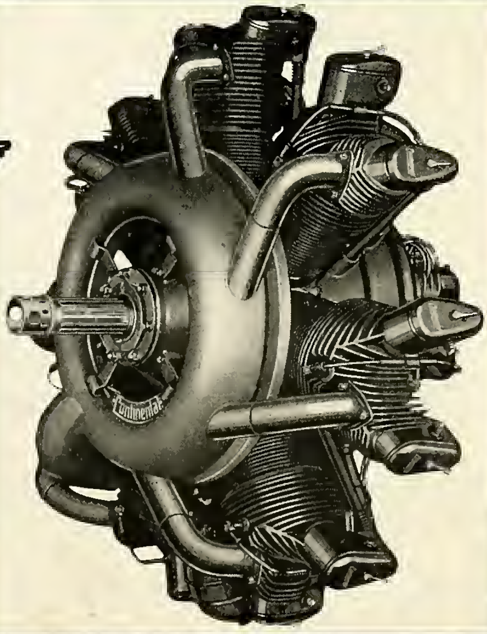
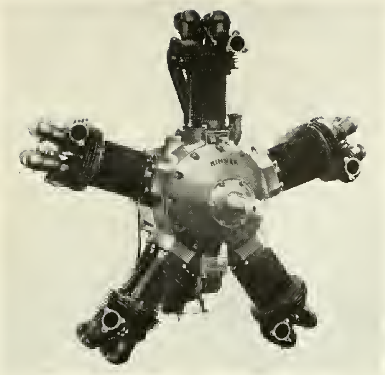




KINNER K5

Kinner Airplane & Motor Corporation, Ltd., Glendale, California

• President and General Manager: Robert Porter. Vice-president: B. L. Graves. Chief Engineer: C. P. Sander.

Five-cylinder, radial, direct-drive, air-cooled. Rated by the Department of Commerce 100 horsepower at 1800 revolutions per minute. ATC 3. Circulating oil system, pressure feed lubrication. Compression ratio 5:1. Bore 4.25 inches. Stroke 5.25 inches. Displacement 372 cubic inches. Length overall 32.31 inches. Diameter overall 45.75 inches. Bare weight 275 pounds. Weight in lbs./h.p. 2.75. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr.

Construction: Crankshaft Bethlehem forging, SAE 3140 steel, one piece, machined, counter balanced and supported on two main bearings of bronze backed babbitt, Norma-Hoffmann ball thrust bearing. Crankcase Bohn cast aluminum alloy. Pistons slipper type Bohn cast aluminum alloy with three American Hammered compression and one oil to each cylinder. Cylinder heads Bohn cast aluminum alloy bolted on forged SAE 1050 steel cylinder barrels having integral fins. Fercrome or Jadson intake and exhaust valves. Individual camshafts for each cylinder. Overhead rocker arms actuated by push rods and enclosed in detachable covers.

Accessories: Scintilla or Bosch magnetos, Stromberg or Holley carburetor, Eclipse air starter, B. G. spark plugs, Air Associates radio shielding.

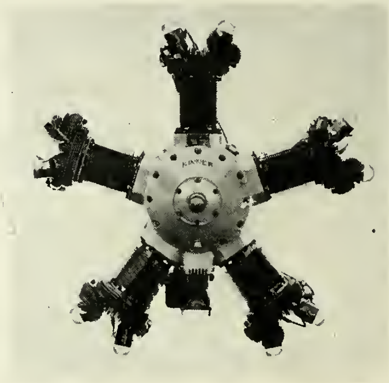
KINNER B5

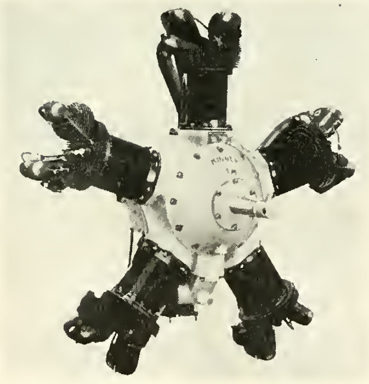
Kinner Airplane & Motor Corporation, Ltd., Glendale, California

• Five-cylinder, radial, direct-drive, air-cooled. Rated by the Department of Commerce 125 horsepower at 1925 revolutions per minute. ATC 51. Circulating oil system, pressure feed lubrication. Compression ratio 5.25:1. Bore 4.625 inches. Stroke 5.25 inches. Displacement 441 cubic inches. Length overall 32.31 inches. Diameter overall 45.37 inches. Bare weight 295 pounds. Weight in lbs./h.p. at sea level 2.36. Fuel consumption at rated horsepower .55 lbs./b.h.p./hr. Oil consumption at rated horsepower .025 lb./b.h.p./hr.

Construction: Crankshaft SAE 3140 forged Bethlehem steel, one piece, machined, counter balanced and supported on two main bearings of bronze backed babbitt, Norma-Hoffmann ball thrust bearings. Master and connecting rods machined all over. Crankcase Bohn cast aluminum alloy. Pistons full skirt type, Bohn cast aluminum alloy with three American Hammered compression and one oil ring to each cylinder. Cylinder heads Aluminum Cooking Utensile Company cast aluminum alloy bolted on forged SAE 1050 steel cylinder barrels having integral fins. Fercrome or Jadson intake and exhaust valves, and individual camshafts for each cylinder.

Accessories: Scintilla or Bosch magnetos, Stromberg or Holley carburetor, Eclipse air starter, B. G. spark plugs, Air Associates radio shielding. Optional equipment includes Lewis thermocouples.





KINNER R5

Kinner Airplane & Motor Corporation, Ltd., Glendale, California

• Five-cylinder, radial, direct-drive, air-cooled. Rated by the Department of Commerce 160 h.p. at 1975 r.p.m. ATC 77. Circulating oil system, pressure feed lubrication. Compression ratio 5:1. Bore 4.87 in. Stroke 5.25 in. Displacement 490 cu. in. Length overall 32.31 in. Diameter overall 45.37 in. Bare weight 305 lbs. Weight in lbs./h.p. at sea level 1.91. Fuel consumption at rated h.p. .55 lbs./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr.

Construction: Crankshaft SAE 3140 forged Bethlehem steel, one piece, machined, counter balanced and supported on two main bearings of bronze backed babbitt, Norma-Hoffmann ball thrust bearing. Master and connecting rods machined all over. Overhead roller bearing rocker arms actuated by push rods and enclosed in detachable covers. Crankcase Bohn cast aluminum alloy containing oil passages with provision for Cuno oil filter, oil pump drive and generator drive. Pistons full skirt type Jahns cast aluminum alloy with three American Hammered compression and one oil ring to each cylinder. Cylinder heads Aluminum Cooking Utensile Company cast aluminum alloy bolted on forged SAE 1050 Bethlehem steel cylinder barrels having integral fins. Fercrome or Jadson valves.

Accessories: Scintilla magneto, Stromberg carburetor, Eclipse air starter, B. G. spark plugs, Air Associates radio shielding, C5, Romec or Evans fuel pump, Cuno oil filter.

KINNER C5

Kinner Airplane & Motor Corporation, Ltd., Glendale, California

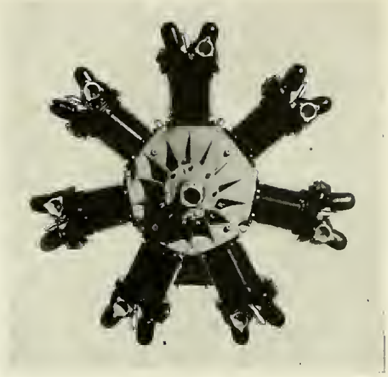
• Five-cylinder, radial, direct-drive, air-cooled. Rated by the Department of Commerce 210 horsepower at 1900 revolutions per minute. ATC 62. Circulating oil system, pressure feed lubrication. Compression ratio 5.25:1. Bore 5.625 inches. Stroke 5.75 inches. Displacement 715 cubic inches. Length overall 34.82 inches. Diameter overall 50 inches. Bare weight 420 pounds. Weight in lbs./h.p. at sea level 2. Fuel consumption at rated horsepower .55 lb./b.h.p./hr. Oil consumption at rated horsepower .025 lb./b.h.p./hr.

Construction: Crankshaft SAE 3140 forged General Metals steel, one piece, machined, counterbalanced and supported on two main bearings of bronze backed babbitt, Norma-Hoffmann ball thrust bearing. Master and connecting rods machined all over. Propeller end of crankshaft SAE standard. Crankcast Bohn cast aluminum alloy containing oil passages with provision for Cuno oil filter, oil pump drive and generator drive. Pistons full skirt type Bohn cast aluminum alloy with three American Hammered compression and one oil ring to each cylinder. Cylinder heads Bohn cast aluminum alloy bolted on forged SAE 1050 Bethlehem steel cylinder barrels having integral fins.

Accessories: Scintilla magnetos, Stromberg carburetor, Eclipse air or inertia starters, B. G. spark plugs, Air Associates radio shielding, C5, Romec or Evans fuel pump, Cuno oil filter.

KINNER C7

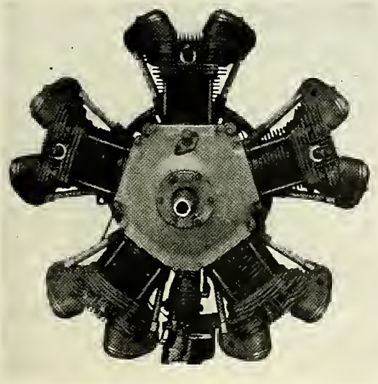
Kinner Airplane & Motor Corporation, Ltd., Glendale, California



• Seven-cylinder, radial, direct-drive, air-cooled. Rated by the Department of Commerce 300 horsepower at 1800 revolutions per minute. ATC 122. Static pressure lubrication. Compression ratio 5.25:1. Bore 5.625 inches. Stroke 6 inches. Displacement 1044 cubic inches. Blower gear ratio 1:1. Length overall 44.125 inches. Diameter overall 51.312 inches. Bare weight 600 lbs. Weight in lbs./h.p. 2. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr.

Construction: Crankshaft SAE 3140 forged Bethlehem steel, two piece carried on three anti-friction bearings, one piece master rod having a bearing of steel backed copper lead. Crankcase Bohn and Aluminum Company of America cast aluminum alloy in two sections. Pistons full skirt type Bohn cast aluminum alloy with three compression and two oil rings to each cylinder. Cylinder heads Bohn cast aluminum alloy bolted on forged SAE 1050 Bethlehem steel cylinder barrels with rocker box integral with head and rearranged finning. Fercrome or Jadson intake and exhaust valves. Electric accessories mounted at or above center line, other accessories below center line.

Accessories: Scintilla magnetos, Stromberg carburetor, Eclipse air or inertia starter, B. G. spark plugs, Air Associates radio shielding, C5, Evans or Romec fuel pump, Cuno oil filter, Lewis thermocouples. Also see data in February, 1934, Aero Digest.



LAMBERT R-266

Lambert Aircraft Corporation, Robertson, Missouri

• President: Wooster Lambert. Vice-president: J. Chasnoff. General Manager: C. W. Bunch. Secretary-Treasurer: Tom Towle.

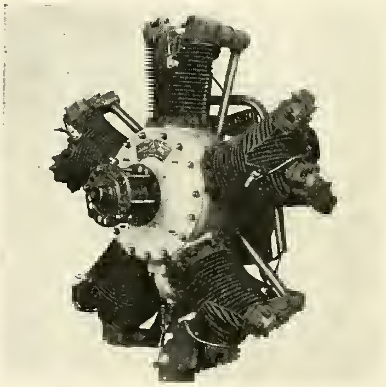
Five-cylinder, radial, direct-drive, air-cooled. Rated by the manufacturer at 85 h.p. at 2250 r.p.m., and by the Department of Commerce at 90 h.p. at 2375 r.p.m. ATC 38. Dry sump and pressure feed lubrication. Compression ratio 5.55:1. Bore 4.25 in. Stroke 3.75 in. Displacement 266 cu. in. Length overall 30.375 in. Diameter overall 33 in. Bare weight including magneto and carburetor 214 lbs. Weight in lbs./h.p. 2.38. Fuel consumption at rated h.p. .578 gal./b.h.p./hr. Oil consumption at rated h.p. .025 gal./b.h.p./hr.

Construction: Crankshaft heat treated chrome nickel steel SAE 3140, two-piece, single-throw carried on three ball bearings, one piece master rod. Crankcase magnesium alloy, two piece, joined on cylinder center line, machine finished. Pistons aluminum with two Perfect Circle compression and two Perfect Circle oil rings to each cylinder. Bearings ball, and babbitt type. Aluminum magnesium heat treated alloy cylinder heads bolted with four long bolts to crankcase. Cylinder barrels cast steel with integral fins; loosely fitted on head permitting easy detachment. Wilcox-Rich intake and exhaust valves.

Accessories: Scintilla magnetos, Stromberg carburetor, Champion spark plugs. Radio shielding optional equipment.

LE BLOND 70 Model 5DE

The LeBlond Aircraft Engine Corporation, Cincinnati, Ohio



• President and General Manager: R. E. LeBlond. Vice-president: William F. Groene. Chief Engineer: W. A. Kimsey.

Five-cylinder, radial, direct-drive, air-cooled. Rated by the manufacturer at 70 horsepower at 1950 revolutions per minute and by the Department of Commerce at 75 horsepower at 2075 revolutions per minute. ATC 48. Lubrication dry sump, full pressure feed with duplex gear-type pump having integral oil filters. Compression ratio 5.35:1. Bore 4.125 inches. Stroke 3.75 inches. Displacement 250.5 inches. Length overall 22.25 inches. Diameter overall 33.25 inches. Bare weight 235 pounds. Weight in lbs./h.p. at sea level 3.35. Fuel consumption at rated horsepower .6 lb./b.h.p./hr. Oil consumption at rated horsepower .015 lb./b.h.p./hr.

Construction: Crankshaft is of forged chrome nickel steel, in one piece. Crankcase is cast aluminum alloy, in one piece, of the barrel-type with an induction manifold cast integral. Chrome nickel steel master rod with split big end, floating gudgeon pins. Pistons are Permite aluminum alloy of the full skirt type with two compression and one oil ring to each cylinder. Cylinder heads and cylinder barrels are cast in one piece of chrome molybdenum alloy with heads and fins integral. There is one intake and one exhaust valve per cylinder.

Accessories: Bosch magnetos, Stromberg carburetor, Champion spark plugs. Radio shielding optional equipment.

LE BLOND 85 Model 5DF

The LeBlond Aircraft Engine Corporation, Cincinnati, Ohio

• Five-cylinder, radial, direct-drive, air-cooled. Rated by the manufacturer at 90 h.p. at 2125 r.p.m. and by the Department of Commerce at 85 h.p. at 2125 r.p.m. ATC 46. Lubrication dry sump, full pressure feed with duplex gear-type pump having integral oil filters. Compression ratio 5.4:1. Bore 4.25 inches. Stroke 3.75 inches. Displacement 266 cubic inches. Length overall 22.25 inches. Diameter overall 33.25 inches. Bare weight 219 pounds. Weight in lbs./h.p. at sea level 2.5. Fuel consumption at rated h.p. at sea level .52 lb./b.h.p./hr. Oil consumption at rated h.p. at sea level .015 lb./b.h.p./hr.

Construction: Crankshaft alloy steel, drop forged, one piece type, crankpin containing aluminum plug for cleaning oil. Crankcase cast aluminum alloy with intake manifold cast integral. Unit assembly gear case contains all accessories. Pistons full skirt type, permanent mold aluminum alloy casting, two compression and one oil ring to each cylinder are located above piston pin which is full floating in piston and connecting rod. Cylinder heads cast aluminum bolted to forged steel barrel, pompadour-type finning, rocker arms mounted on ball bearings in separate cast aluminum boxes fastened to heads with studs. Connecting rods drop forged steel, master rod has split bearing and wrist pins are retained by the connecting rod bolts.

Accessories: Bosch magnetos, Holley carburetor, double gear-type oil pump.

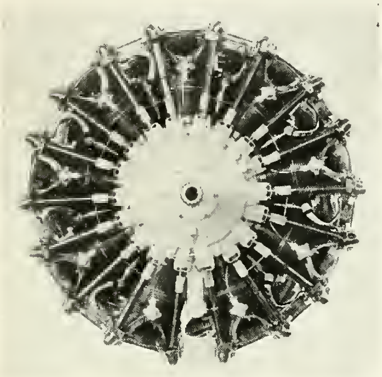
LE BLOND 110 Model 7DF

The LeBlond Aircraft Engine Corporation, Cincinnati, Ohio

• Seven-cylinder, radial, direct-drive, air-cooled. Rated by the manufacturer at 119 horsepower at 2275 revolutions per minute and by the Department of Commerce at 110 horsepower at 2150 revolutions per minute. ATC 52. Lubrication dry sump, full pressure feed with duplex gear-type pump having integral oil filters. Compression ratio 5.4:1. Bore 4.25 inches. Stroke 3.75 inches. Displacement 372 cubic inches. Length overall 23.062 inches. Diameter overall 33.25 inches. Bare weight 275 pounds. Weight in lbs./h.p. at sea level 2.3. Fuel consumption at rated h.p. .54 lbs./b.h.p./hr. Oil consumption at rated h.p. .015 lb./b.h.p./hr.

Construction: crankshaft alloy steel, drop forged, one-piece type, crankpin contains aluminum plug for cleaning oil. Crankcase aluminum alloy casting with intake manifold cast integral. Unit assembly gear case contains all accessories. Pistons full skirt type, aluminum alloy casting, two compression and one oil ring to each cylinder are located above piston pin which is full floating in piston and connecting rod. Cylinder heads cast aluminum bolted to forged steel barrel, pompadour-type finning, rocker arms mounted on ball bearings in separate cast aluminum boxes fastened to head with studs. Connecting rods drop forged steel, master rod has split bearing.

Accessories: Scintilla magnetos, Stromberg or Holley carburetor, double gear-type oil pump.



LYCOMING R-680-9 and R-680-11

Lycoming Manufacturing Company, Williamsport, Pennsylvania

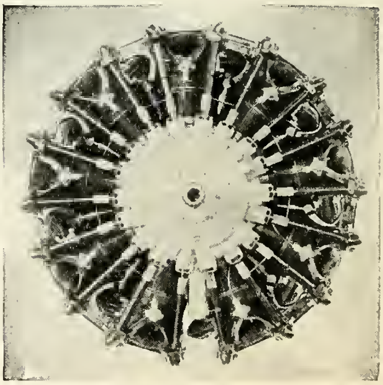
• President: W. H. Beal. Vice-president and General Manager: F. M. Bender. Sales Manager: Z. H. Whiteman, Jr. Chief Engineer: Val Cronstedt. Export representative: J. H. Homs, 44 Whitehall, Street, N. Y.

Nine-cylinder, radial, direct-drive, air-cooled. (Models R-680-9 and R-680-11 respectively; data on R-680-11 indicated in brackets). Rated at 240 (225) h.p. at 2000 (2100) r.p.m. Octane fuel 80 (65). Gear-type oil pump assembly, driven by spiral gearing from rear accessory, drive shaft provides forced lubrication through the hollow crankshaft to the valve gear, master rod bearings, link pin bearings and accessories. Compression ratio 6.5:1 (5.5:1). Bore 4.625 in. Stroke 4.5 in. Displacement 680.4 cu. in. Length overall 32.625 in. Diameter overall 43.5 in. Bare weight 470 lbs. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr.

Construction: Crankshaft single throw, two piece forgings of alloy steel, hollowed; counterweights forged integral with crank cheeks. Crankcase cast magnesium alloy with reinforcing ribs, throughout; front section contains thrust bearing and valve operating mechanism; main section supports cylinders and rear wall supports rear main bearings; rear section encloses accessory drives. Pistons forged aluminum alloy; five rings to each cylinder, four at top and one at bottom. Cylinder heads aluminum alloy screwed and shrunk on forged steel barrels.

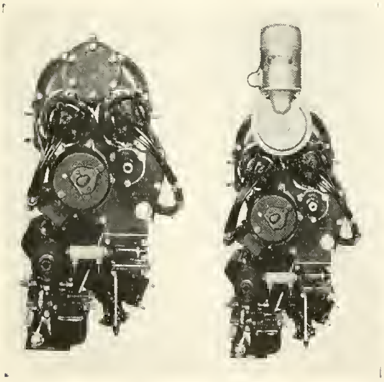
LYCOMING R-680-10 and R-680-12

Lycoming Manufacturing Company, Williamsport, Pennsylvania



• Nine-cylinder, radial, direct-drive, air-cooled. (Models R-680-10 and R-680-12 respectively; data on R-680-12 indicated in brackets). Rated at 260 (245) horsepower at 2300 (2300) revolutions per minute. Octane fuel 80 (65). Gear-type oil pump assembly, drive by spiral gearing from rear accessory, drive shaft provides forced lubrication throughout the hollow crankshaft to the valve gear, master rod bearings, link pin bearings and accessories. Compression ratio 6.5:1 (5.5:1). Bore 4.625 in. Stroke 4.5 in. Displacement 680.4 cu. in. Length overall 32.625 in. Diameter overall 43.5 in. Bare weight 470 lbs. Fuel consumption at rated h.p. .55 lb./b.h.p./hr. Oil consumption at rated h.p. .025 lb./b.h.p./hr.

Construction: Crankshaft single throw, two piece forgings of alloy steel hollowed; counterweights forged integral with crank cheeks; shaft carried on two main ball bearings and one deep groove ball thrust bearing. Crankcase cast magnesium alloy with reinforcing ribs, throughout; front section contains thrust bearing and valve operating mechanism; main section supports cylinders; rear section encloses accessory drives. Pistons forged aluminum alloy; five rings to each cylinder, four at top and one at bottom; gudgeon pins float in both pistons and connecting rods. Cylinder heads aluminum alloy screwed and shrunk on forged steel barrels. These models are for use with controllable pitch propellers.



MENASCO B4 Pirate

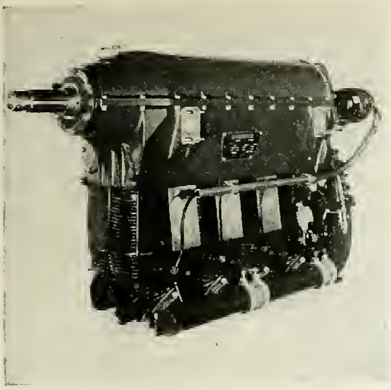
Menasco Manufacturing Company, Los Angeles, California

• President and General Manager: A. S. Menasco. Sales Manager and Secretary: Charles F. McReynolds. Chief Engineer: H. G. Townsend. Export representatives: Commercial Steels (Australia) Ltd., Alexandria, N.S.W., Sydney, Australia. Tri-American Aviation, Inc., N. Y., N. Y.

Four-cylinder, inverted-in-line, direct-drive, air-cooled. Rated by the Department of Commerce 95 h.p. at 2000 r.p.m. ATC 65. Dry sump, with full pressure lubrication to all bearings, one pressure and two scavenging pumps. Compression ratio 5.5:1. Bore 4.5 in. Stroke 5.125 in. Displacement 326 cu. in. Length overall 47.75 in. Height overall 28 in. Width overall 11.125 in. Bare weight 285 pounds, with accessories 297 pounds. Weight in lbs./h.p. 3. Fuel consumption at rated horsepower .54 pounds per brake horsepower per hour. Oil consumption at rated horsepower .006 lb./b.h.p./hr.

Construction: Crankshaft Wyman-Gordon chrome nickel steel. Crankcase cast aluminum alloy in two sections. Pistons cast aluminum alloy with three Sealed Power compression and one oil ring to each cylinder. Cylinder heads cast aluminum alloy shrunk, screwed and pinned in Cheney cast iron or steel barrels. Jadson exhaust and intake valves. Electrical or battery ignition.

Accessories: Bosch or Scintilla magnetos, Stromberg carburetor, Eclipse or Bosch starter, B. G. spark plugs, Evans fuel pump, screen-type oil and air filters.



MENASCO Pirate C4 and C4S

Menasco Manufacturing Company, Los Angeles, California

• Four-cylinder, inverted-in-line, direct-drive, air-cooled. (Models C4 and C4S respectively; data on C4S indicated in brackets.) ATC 67. Rated by the Department of Commerce 125 (150) h.p. at 2175 (2260) revolutions per minute (at 3000 ft.). Compression ratio 5.5:1. (C4S is supercharged, with a blower gear ratio of 9.6:1.) Bore 4.75 in. Stroke 5.125 in. Displacement 363 cu. in. Dry sump, pressure lubrication from external tank to all bearings, one pressure and two scavenging pumps. Length overall 47.75 (47.53) in. Height overall 28 (28.562) in. Width overall 11.25 in. Bare weight 290 (305) lbs., with accessories 302 (317) lbs. Weight in lbs./h.p. 2.32 (2.03). Fuel consumption at rated h.p. .50 (.56) lb./b.h.p./hr. Oil consumption at rated h.p. .010 (.018) lb./b.h.p./hr.

Construction: Crankcase Wyman-Gordon chrome nickel steel. Crankcase cast aluminum alloy in two sections. Pistons cast aluminum alloy special ribbed waffle head design with three Sealed Power compression and one oil ring to each cylinder. Cylinder heads cast aluminum alloy screwed and pinned in cast nickel iron or steel barrels. Jadson exhaust and intake valves. Federal-Mogul bearings for main and connecting rods; SKF, Fafnir, Norma-Hoffmann anti-friction bearings elsewhere. Supercharged version has centrifugal type supercharger.

Accessories: Bosch or Scintilla magnetos, Stromberg carburetor, Eclipse starter.

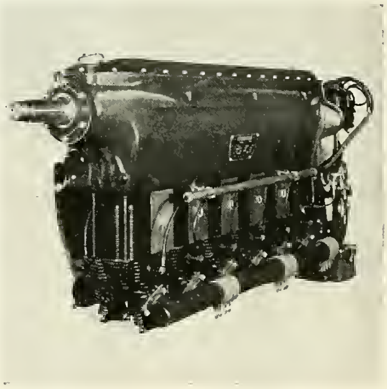
MENASCO Buccaneer B6 and B6S

Menasco Manufacturing Company, Los Angeles, California

• Six-cylinder, inverted-in-line, direct-drive, air-cooled. (Models B6 and B6S respectively; data on B6S indicated in brackets.) ATC 68. Rated by the Department of Commerce 160 (200) h.p. at 1975 (2250) r.p.m. (at 4500 ft.). Compression ratio 5.5:1. (B6S is supercharged, with a blower gear ratio of 8.75:1.) Bore 4.5 inches. Stroke 5.125 in. Displacement 489 cu. in. Dry sump, pressure lubrication to all main and connecting rod bearings, one pressure and two scavenging pumps. Length overall 59.43 in. Height overall 28.31 in. Width overall 11.87 in. Bare weight 385 (415) pounds, with accessories 398 (428) pounds. Weight in lbs./h.p. 2.4 (2.08). Fuel consumption at rated h.p. .54 (.56) lb./b.h.p./hr. Oil consumption .006 (.018) lb./b.h.p./hr.

Construction: Crankshaft Wyman-Gordon chrome nickel steel. Crankcase cast aluminum alloy in two sections. Pistons cast aluminum alloy special ribbed waffle head design with three Sealed Power compression and one oil ring to each cylinder. Cylinder heads cast aluminum alloy screwed and pinned in cast iron or steel barrels. Jadson exhaust and intake valves. Federal-Mogul bearings for main and connecting rods; SKF, Fafnir and Norma-Hoffmann anti-friction bearings elsewhere. Supercharged version has centrifugal type supercharger.

Accessories: Bosch magnetos, Stromberg carburetor, Eclipse starter, B. G. spark plugs, Evans fuel pump.



NATIONAL 35

National Airplane and Motor Company, Billings, Montana

• President and General Manager: A. B. Green. Vice-president: R. J. O'Malley. Chief Engineer: Hugh Thompson.

Two-cylinder, opposed, direct-drive, air-cooled. Rated by the manufacturer at 37 horsepower at 2600 revolutions per minute and 30 horsepower at 2150 revolutions per minute; it is rated by the Department of Commerce at 35 horsepower at 2500 revolutions per minute, and at 30 horsepower at 2150 revolutions per minute. Fuel rating 78 octane. Pressure lubrication. Compression ratio 6:1. Bore 4 inches. Stroke 3.625 inches. Length overall 20 inches. Height overall 18 inches. Width overall 22 inches. Bare weight 89 pounds; with accessories 98 pounds. Weight in pounds per horsepower at sea level 2.64. Fuel consumption at rated horsepower .60 pound per brake horsepower per hour.

Construction: The crankshaft is a two throw, drop forged, counterbalanced type, and the crankcase is of aluminum. Pistons are of solid aluminum with four piston rings to each cylinder, three being compression and one an oil scraper ring. Cylinder barrels and cylinder heads are of chrome nickel and the connection rods are of duralumin. Babbit bearings are used throughout and there is one Thompson intake and one Thompson exhaust valve per cylinder.

Accessories: Scintilla magnetos, Stromberg carburetor, A.C. spark plugs.

PRATT AND WHITNEY Wasp and Wasp Junior

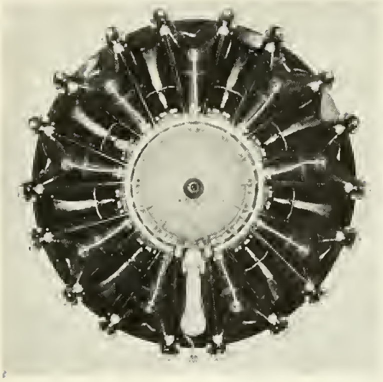
Pratt and Whitney Aircraft Company, East Hartford, Connecticut

• President: Donald L. Brown. Vice-President: L. S. Hobbs. Vice-president in charge of Manufacturing: B. H. Gilpin. Sales Manager: T. E. Tillinghast. Chief Engineer: A. V. D. Willgoos. Export representative: United Aircraft Exports Corporation, E. Hartford, Conn.

The Series H1 Wasps, 9-cylinder, radial, air-cooled, feature automatic lubrication by engine pressure or splash of all principal moving parts and improvements in construction detail. Parts redesigned and strengthened are master rod and link rods, crankcase, supercharger drive, valves, pistons and rings, crankshaft main bearings and the accessory drive. New developments incorporated in these engines consist of automatic oil temperature control, priming carburetor, fine fin cylinder heads, shelf-mounted cam, pressure baffles between cylinders, oil tightness throughout, controllable-pitch propeller control on rear of sump, new and shorter ignition wiring and a short hot spot in the induction system.

Construction: Crankshaft is 5% nickel carborizing steel, the rear section telescoping over the front section and held in angular position by 31 splines. Crankcase in two sections; nose section of heat treated aluminum alloy; with valve tappets mounted in guides, rear section comprises two major castings, the blower portion for the internal supercharger and outlets to which the cylinders are connected and the rearmost casting which forms the supercharger diffuser section and carburetor inlet elbow as well as the support for accessories. Propeller shaft is a nickel steel forging carried on two bearings, the forward being of the anti-friction type, the rear of the plain type. Pistons are machined from aluminum alloy forgings with four compression and one oil ring to each cylinder. Cylinders are of composite construction, the barrel portions machined from steel forgings; heads are aluminum alloy castings, screwed and shrunk on the barrels; rocker boxes are cast integral with the heads; exhaust ports provide maximum cooling, are easily connected to the manifold and employ fine finning both on the head and barrel, providing adequate radiating surface. The improved spring coupling has slightly heavier springs than previously used.

Construction details of the Wasp Junior engines are similar to the Hornet engines.



PRATT AND WHITNEY WASP H1 Series

Pratt and Whitney Aircraft Company, East Hartford, Connecticut

• The Wasp H1 series consists of two direct drive engines, the T1H1 and S3H1, and three geared engines, the S1H1-G, S2H1-G, S3H1-G. They have a compression ratio of 6:1, bore of 5.75 in., stroke of 5.75 in., displacement of 1340 cu. in., fuel consumption at cruising r.p.m. of .48 lb./b.h.p./hr., and oil consumption of .035 lb./b.h.p./hr.

The T1H1 has a manufacturers rating of 525 h.p. at 2100 r.p.m., and the S3H1 is rated at 550 h.p. at 2200 r.p.m. at 5000 ft. Both use 80 octane fuel and have a blower gear ratio of 10:1, diameter of 51.437 in., length overall of 43.375 in., and bare weight of 781 lbs., weighing at sea level and altitude, respectively, 1.4 lbs./h.p.

The S1H1-G has a Department of Commerce rating of 550 h.p. at 2200 r.p.m. at 8000 feet using 87 octane fuel (ATC 129). The S2H1-G is rated by the manufacturer at 500 h.p. at 2200 r.p.m. at 10,500 ft., and the S3H1-G is rated at 550 h.p. at 2200 r.p.m. at 5000 ft., both use 80 octane fuel. The S1H1-G and S2H1-G have a blower gear ratio of 12:1, and the S3H1-G has a blower gear ratio of 10:1. All have an overall length of 48.25 in., diameter of 51.437 in., and a bare weight of 875 lbs. Weight in lbs./h.p. for the S1H1-G and S3H1-G at sea level and altitudes is 1.6 and 1.7 for the S2H1-G.

Accessories: Scintilla magnetos, Stromberg carburetors, cylinder cooling baffles, oil pump, radio shielding, generator drive.

PRATT AND WHITNEY WASP JUNIOR B Series

Pratt and Whitney Aircraft Company, East Hartford, Connecticut

• The Wasp Junior B series consists of three direct drive engines, the TB, T1B, SB. All have a bore of 5.187 inches, a stroke of 5.187 inches, displacement of 985 cubic inches, overall length of 42.125 inches, overall diameter of 45.75 inches, bare weight of 596 pounds, fuel consumption at cruising speed of .48 pound per brake horsepower per hour, oil consumption of .035 pound per brake horsepower per hour.

The TB is rated by the Department of Commerce at 420 horsepower at 2200 revolutions per minute at 2200 feet using 80 octane fuel (ATC 85) and has a blower gear ratio of 8:1, a compression ratio of 6:1 and weighs 1.4 pounds per horsepower at sea level. The T1B is rated by the Department of Commerce at 345 horsepower at 2000 revolutions per minute at sea level using 73 octane fuel (ATC 113) and has a blower gear ratio of 8:1, compression ratio of 5:1 and weighs 1.8 pounds per horsepower at sea level. The SB is rated by the manufacturer and the Department of Commerce at 400 horsepower at 2200 revolutions per minute at 5000 feet using 80 octane fuel (ATC 123) and has a blower gear ratio of 6:1, compression ratio of 10:1.

Accessories: Scintilla magnetos, Stromberg carburetors, cylinder cooling baffles, oil pump, radio shielding, generator drive, propeller hub attaching parts, tachometer drive, auxiliary vacuum pump drive, hot spot and tees.

PRATT AND WHITNEY Hornet

Pratt and Whitney Aircraft Company, East Hartford, Connecticut

• All of the twelve engines in the Hornet group are basically similar in construction, the E series engines differing principally from the D and D1 series engines in size and manner of lubrication of valves. They are nine-cylinder, fixed radial, air-cooled, pressure lubricated; 6.125 inch bore, 6.375 inch stroke, 1690 cubic inch displacement; fuel consumption at cruising r.p.m. .48 lb. per b.h.p./hr.; oil consumption at rated h.p. .035 lb. per b.h.p./hr.

Construction: Crankshaft single throw, two-piece type, nickel alloy; front and rear section fit into each other, both held in proper angular relation by splines and united by a through bolt; steel mortised counterweights shrunk and riveted into crank webs. Crankcase forged aluminum alloy in two sections divided in cylinder plane; nose section aluminum casting carrying deep row ball thrust bearing and housing cam and cam gear train; accessory section in rear; supercharger impeller shaft in line with crankshaft and driven from it by two pairs of spur gears. Pistons machined, forged aluminum alloy, five rings to each cylinder, four compression, one oil. Cylinder heads cast aluminum with aluminum-bronze valve seats shrunk, and rocker arm housing integral. Cylinder barrels forged steel with integral fins; inlet and exhaust ports finned.

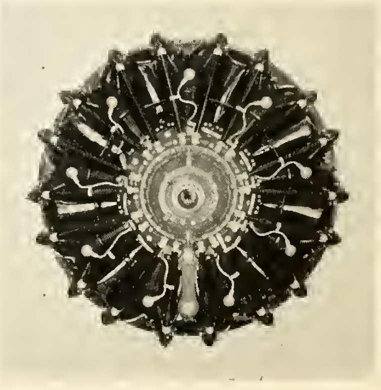
All Hornet engines are equipped to accommodate a Hamilton Standard controllable-pitch propeller.

PRATT AND WHITNEY HORNET 1690 D and D1 Series

Pratt and Whitney Aircraft Company, East Hartford, Connecticut

• The Hornet 1690 D and D1 series consists of four direct drive engines, the T1D1, T2D1, SD, and S4D1, and three geared engines, the T1D1-G, SD-G, and S3D1-G. The T1D1 is rated by the Department of Commerce (ATC 92) at 700 h.p. at 2000 r.p.m., using 87 octane fuel; the T2D1 at 660 h.p. at 2000 r.p.m., using 80 octane fuel (ATC 99); the SD at 675 h.p. at 2050 r.p.m. at 6000 ft., using 87 octane fuel (ATC 106); the S4D1, at 650 h.p. at 2050 r.p.m. at 3000 ft., using 80 octane fuel (ATC 100). The T1D1, T2D1 and S4D1 have a compression ratio of 6:1 and a blower gear ratio of 10:1; the SD has a compression ratio of 6.5:1 and a blower gear ratio of 12:1. The direct drive engines have an overall length of 45.75 in., overall diameter of 55.437 in., a bare weight of 880 pounds. Their weight per h.p. is 1.3 lbs.

The T1D1-G (ATC 109) and SD-G (ATC 105) are each rated at 700 h.p. at 2150 r.p.m., the latter at 6500 ft. The S3D1-G (ATC 117) is rated at 670 h.p. at 2150 r.p.m. at 5000 ft. The T1D1-G and S3D1-G have a compression ratio of 6:1 and a blower gear ratio of 10:1, and the SD-G has a compression ratio of 6.5:1 and a blower gear ratio of 12:1. The geared engines have an overall length of 50.75 in., a propeller shaft ratio of 3:2, use 87 octane fuel and weigh 980 pounds. Diameter of the SD-G is 54.437 in.; of the T1D1-G and S3D1-G 55.437 in. Weight in pounds per h.p. at sea level or altitude of the T1D1-G and SD-G is 1.4; of the S3D1-G 1.5.



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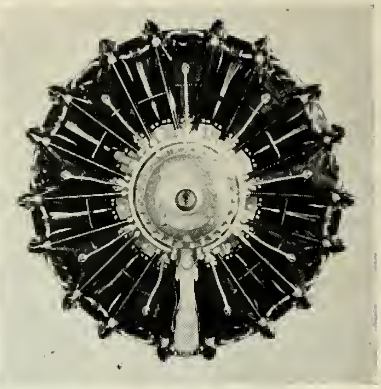
PRATT AND WHITNEY HORNET 1690 E Series

Pratt and Whitney Aircraft Company, East Hartford, Connecticut



• The Hornet 1690 E Series consists of two direct drive engines, the T1E and S3E, and three geared engines, the S1E-G, S2E-G, S3E-G. The T1E has a manufacturers rating of 725 horsepower at 2050 revolutions per minute at sea level, using 87 octane fuel. The S3E has a manufacturers rating of 650 horsepower at 2050 revolutions per minute at 5500 feet and uses 80 octane fuel. Both engines have a compression ratio of 6:1, blower gear ratio of 11:1, length overall of 45.375 inches, diameter overall of 54.437 inches, and weigh 920 pounds.

The S1E-G and S2E-G are both rated 750 horsepower at 2250 revolutions per minute, the former at 7000 feet, the latter at 3000 feet. The S1E-G has ATC 136 and both use 87 octane fuel. The S3E-G is rated 675 horsepower at 2250 revolutions per minute at 6100 feet, using 80 octane fuel. The S2E-G and S3E-G have a compression ratio of 6:1, and S1E-G has a compression ratio of 6.5:1 and a blower gear ratio of 12:1. The blower gear ratio for the S2E-G and S3E-G is 10:1 and 11:1 respectively. The geared engines have a propeller shaft ratio of 3:2, an overall length of 51 inches, a diameter of 54.437 inches and a bare weight of 1015 lbs.

Accessories: Scintilla magnetos, Stromberg carburetors, cylinder cooling baffles, oil pump, radio shielding, thermostatic oil temperature control valve, generator drive, propeller hub attaching parts, single tachometer drive, hot spot and tees.

PRATT AND WHITNEY Twin Wasp and Twin Wasp Junior

Pratt and Whitney Aircraft Company, East Hartford, Connecticut

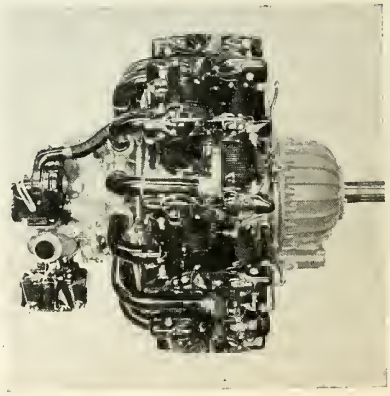
• The double-row engines in the Pratt and Whitney Twin Wasp and Twin Wasp Junior series total four models, two in each group. They are 14-cylinder, radial, air-cooled engines similar in construction, with propeller reduction gears.

Construction: Crankshaft double throw, one-piece type, supported by three roller bearings, one in the middle and one on each side of the crankcase; thrust taken by ball bearing behind propeller; steel counter weights shrunk and riveted onto crank webs; master rods have detachable big end caps; six I-section articulated rods for each row each bronze bushed for both piston and knuckled pin. Crankcase aluminum alloy forgings, divided into three sections, the forward and rear sections carrying tappets and tappet guides for each bank of cylinders and the center section supporting the center main bearing; sections attached by through bolt and flanges of cylinders; accessory section attached to blower section supports accessories. Pistons forged aluminum alloy machined; flat head type with three or four compression rings (depending upon model) and one oil ring to each cylinder. Cylinder heads built up cast aluminum screwed and shrunk onto a forged steel barrel having integral fins; hemispherical combustion chamber, with valves placed on plane at right angles to crankshaft; aluminum bronze valve seats shrunk into head; rocker arm housings integral with cylinder head; intake and exhaust ports finned. One inlet and one exhaust valve per cylinder actuated by rocker arms and push rods of heat treated aluminum alloy with steel ball ends; two cams, one in front of crankcase and the other in the rear, driven by spur reduction gears directly off crankshaft; valve tappets carried in same crankcase members as cams; valve gear completely enclosed; internally drilled passages for lubrication in both ends of push rods, in rocker arms and rocker bearings. Propeller reduction gear planetary type; consists of central or sun gear fastened to reduction gear housing.

Accessories on both engines include Scintilla magnetos, Stromberg carburetors, cylinder cooling baffles, oil pump, radio shielding, generator drive, propeller hub attaching parts, tachometer drive, auxiliary vacuum pump drive, hot spot and tees.

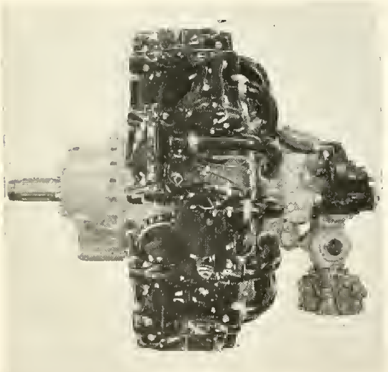
TWIN WASP JUNIOR A1 Series

Pratt and Whitney Aircraft Company, East Hartford, Connecticut



• The Twin Wasp Jr. A1 Series engines consist of two geared engines, the SA1-G and the S1A1-G. Both have a bore of 5.187 inches, stroke of 5.187 inches, displacement of 1535 cubic inches, fuel consumption at cruising speed of .48 pound per brake horsepower per hour, oil consumption at rated horsepower of .035 pound per brake horsepower per hour, propeller shaft ratio of 3:2 or 4:3, blower gear ratio of 10:1, overall length of 54.5 inches, overall diameter of 43.875 inches, bare weight (3:2) of 999 pounds or (4:3) 1009 pounds, are dry sump pressure lubricated, and are equipped for a Hamilton Standard controllable pitch propeller.

Drives, ratio to crankshaft, with the direction of ratio as seen facing the drive are identical in both engines; fuel pump 1:1, counterclockwise; generator 1.5:1 clockwise, tachometer .5:1, starter 1:1 counterclockwise, vacuum pump 1:1 counterclockwise. The SA1-G is rated by the manufacturer and the Department of Commerce at 700 horsepower at 2500 revolutions per minute at 8500 feet using 87 octane fuel (ATC 95). It has a compression ratio of 6.5:1, and its weight per horsepower at its rated altitude is 1.4. The S1A1-G is rated by the manufacturer at 650 horsepower at 2400 revolutions per minute at 7000 feet and by the Department of Commerce at 660 horsepower at 2400 revolutions per minute at 7000 feet using 80 octane fuel (ATC 107). It has a compression ratio of 6:1.



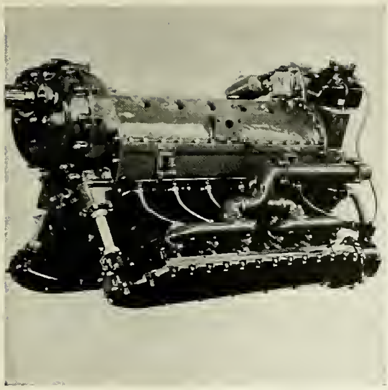
PRATT AND WHITNEY Twin Wasp A1 and A2 Series

Pratt and Whitney Aircraft Company, East Hartford, Connecticut

• The Twin Wasp engines are manufactured in the A1 and A2 series, one engine being in each group. These engines are the S1A2-G and the SA2-G. Both have a bore of 5.5 inches, stroke of 5.5 inches, displacement of 1830 cubic inches, fuel consumption at cruising speed of .48 pound per brake horsepower per hour, oil consumption at rated horsepower of .035 pound per brake horsepower per hour, propeller shaft ratio of 3:2, overall length of 56.25 inches, overall diameter of 47.875 inches, bare weight of 1174 pounds, are dry sump pressure lubricated, are equipped for a Hamilton Standard controllable-pitch propeller.

Drives, ratio to crankshaft, with direction of rotation as seen facing the drive are identical on both engines; fuel pump 1:1 counterclockwise, generator 1.5:1 clockwise, tachometer .5:1, starter 1:1 counterclockwise, vacuum pump 1:1 counterclockwise.

The S1A2-G is rated by the manufacturer and the Department of Commerce at 800 horsepower at 2400 revolutions per minute at 7000 feet, using 87 octane fuel (ATC 137). It has a compression ratio of 6.5:1, blower gear ratio of 11:1, and its weight per horsepower at its rated altitude is 1.4. The SA2-G is rated by the manufacturer at 750 horsepower at 2400 revolutions per minute at 6500 feet, using 80 octane fuel. It has a compression ratio of 6:1, a blower gear ratio of 10:1, and its weight per horsepower at its rated altitude is 1.5.



RANGER V-770-SG

Ranger Engineering Corporation, Farmingdale, New York

• President: Sherman M. Fairchild. Vice-president: D. B. Cox. General Manager: Walter F. Davis.

Twelve-cylinder, inverted Vee, geared, air cooled. Rated by the manufacturer and Department of Commerce at 420 horsepower at 2800 revolutions per minute. ATC 84. Bearings pressure lubricated; camshaft and valve mechanism, pressure and spray lubricated. Compression ratio 6:1. Blower gear ratio 7.71:1. Propeller shaft ratio 3:2. Bore 4 in. Stroke 5.125 in. Displacement 772.8 cu. in. Length overall 59.875 in. Height overall 31.91 in. Width overall 28 in. Bare weight 600 lbs. Weight per h.p. at sea level 1.43 lbs. Fuel consumption .56 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr.

Construction: Crankshaft six throw, seven bearing, chrome nickel steel forging, machined all over. Bearings, steel backed, lead-copper lined. Pistons trunk-type, Y alloy, piston rings, four to each cylinder, one oil, three compression. Cylinder heads spherical combustion chamber, cast Y alloy. Cylinder barrels machined from mild carbon steel with integral fins. Crankcase aluminum alloy, semi-elliptical cross section, parted on crankshaft centerline.

Accessories: vane-type supercharger, Scintilla magneto, Stromberg carburetor, Eclipse starter, B.G. or HT spark plugs. Optional accessories include Packard or Breeze radio shielding, Air Corps fuel pump, Harrison oil cooler, Air Maze air filter.

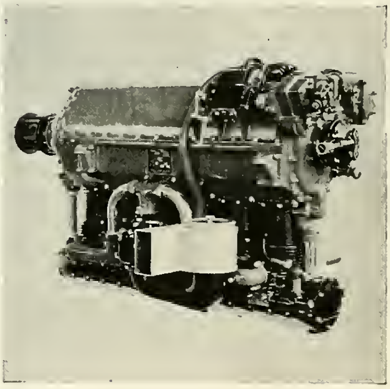
RANGER 6-390 and 6-390-B

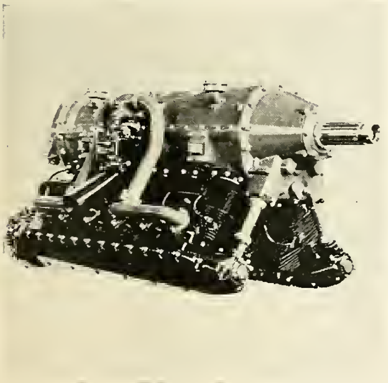
Ranger Engineering Corporation, Farmingdale, New York

• Six-cylinder, inverted, in-line, direct-drive, air-cooled. (Models 6-390 and 6-390-B respectively; data on 6-390-B indicated in brackets). Rated by the manufacturer at 125 (150) h.p. at 2150 (2300) r.p.m. Department of Commerce rating 120 (145) h.p. at 2150 (2250) r.p.m. ATC 57. Bearings pressure lubricated; camshaft and valve mechanism pressure and spray lubricated. Compression ratio 5.2:1 (6:1). Bore 4 in. Stroke 5.125 in. Displacement 386.4 cu. in. Length overall 50.87 in. Height overall 31.781 in. Width overall 20.25 in. Bare weight 350 lbs. Weight per h.p. at sea level 2.92 (2.33) lbs. Fuel consumption .55 (.50) lb./b.h.p./hr. Oil consumption .020 lb./b.h.p./hr. Octane fuel rating 57 (73).

Construction: Crankshaft six throw, seven bearing, chrome nickel steel forging, machined all over. Crankcase semi-elliptic cross-section, parted on crankshaft center line, aluminum alloy. Bearings bronze backed, babbitt lined. Pistons trunk type, Y alloy, piston rings four to each cylinder, one oil, three compression. Cylinder heads spherical combustion chamber, cast Y alloy. Cylinder barrels machined from extruded mild carbon steel with integral fins. Valves one solid tulip-type intake, one hollow tulip-type exhaust.

Accessories: Scintilla PN-6D magneto, Stromberg NA-R4A carburetor, B.G. or HT spark plugs, integral Ranger oil filter. Optional accessories include Eclipse starter.





RANGER V-770-B and V-770-SB

Ranger Engineering Corporation, Farmingdale, New York

• Twelve-cylinder, inverted Vee, direct drive, air cooled. (Models V-770-B and V-770-SB respectively; data on V-770-SB indicated in brackets.) Rated by the manufacturer at 300 (350) h.p. at 2300 (2250) r.p.m. Bearings pressure lubricated; camshaft and valve mechanism pressure and spray lubricated. Compression ratio 6:1. Bore 4 inches. Stroke 5.125 inches. Displacement 772.8 cubic inches. Length overall 58 inches. Height overall 31.91 inches. Width overall 28 inches. Bare weight 545 (565) pounds. Weight per horsepower at sea level 1.8 (1.6). Fuel consumption at rated horsepower .5 (.52) pound per brake horsepower per hour. Oil consumption .025 pound per brake horsepower per hour. Octane fuel rating 73 (80).

Construction: Crankshaft, six-throw, seven bearing, chrome nickel steel forging, machined all over. Bearings, steel backed, lead-copper lined. Pistons trunk-type, Y alloy, piston rings, four to each cylinder, one oil, three compression. Cylinder heads spherical combustion chamber, cast Y alloy. Cylinder barrels machined from mild carbon steel with integral fins. Crankcase aluminum alloy, semi-elliptical cross section, parted on crankshaft centerline. One intake and one exhaust valve per cylinder.

Accessories: Scintilla magneto, Stromberg carburetor, Eclipse starter, B.G. or HT spark plugs. Optional accessories include Packard or Breeze radio shielding.

SZEKELY SR-3 Model O

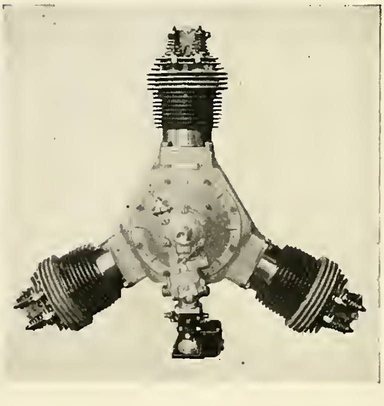
Aviation Holding Company, Holland, Michigan

• President: D. S. Kiskadden, Vice-president: L. D. Buhl. General Manager and Sales Manager: F. E. Bradfield.

Three-cylinder, radial, direct-drive air-cooled. Rated by manufacturer and Department of Commerce at 45 horsepower at 1750 revolutions per minute. ATC 70. Force feed, gear pump lubrication. Compression ratio 4.6:1. Bore 4.125 inches. Stroke 4.75 inches. Displacement 190.4 cubic inches. Length overall 25 inches. Height overall 36 inches. Weight with accessories 147 pounds. Weight per horsepower at sea level 3.2 pounds. Fuel consumption .63 pound per brake horsepower per hour. Oil consumption .016 pound per brake horsepower per hour.

Construction: Crankshaft chromium nickel steel SAE 3140, one piece, drop forged, machined all over; nickel bronze balance weights. Crankcase aluminum alloy, barrel type, induction manifold cast integrally. Ball bearings. Pistons aluminum alloy castings, three Renu rings to each cylinder, floating hollow gudgeon pins. Cylinder heads cast aluminum alloy bolted to cylinder barrel. Cylinder barrels close-grained nickel cast iron, integral fins. Valves overhead Wilcox-Rich bronze intake and exhaust, nickel bronze seats shrunk and screwed into place. Separate timing gear for each cylinder, one cam with bell cranks, operates both valves.

Accessories: Bosch or Scintilla magnetos, Stromberg or Zenith carburetor.



WARNER Scarab Junior

Warner Aircraft Corporation, Detroit, Michigan

• President and General Manager: W. O. Warner. Vice-president and Sales Manager: Ralph R. Irwin. Chief Engineer: Ludwig A. Majneri.

Five-cylinder, radial, direct-drive, air-cooled. Rated by the manufacturer and the Department of Commerce at 90 h.p. at 2025 r.p.m. ATC 54. Force feed dry sump lubrication. Compression ratio 5.2:1. Bore 4.25 in. Stroke 4.25 in. Displacement 301 cu. in. Length overall (without starter) 28.5 in. Height overall 36.56 in. Bare weight 230 lbs. Weight per lbs./h.p. at sea level 2.5. Fuel consumption .55 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr.

Construction: Crankshaft chrome nickel steel forging, one piece, single throw. Crankcase heat treated aluminum alloy, in two halves joined on cylinder centerline. Bearings ball for the main bearings, high "L" head bronze for connecting rod bearings. Pistons heat treated aluminum alloy, one oil, two compression piston rings to each cylinder. Cylinder heads heat treated aluminum alloy, rocker arm housing cast integral with cylinder head. Cylinder barrels chrome molybdenum steel forgings, heads permanently shrunk and bolted to cylinder.

Accessories: Scintilla magnetos, Holley carburetor, AC spark plugs. Optional equipment includes starter, oil filter, air filter, thermocouples. Battery ignition available.

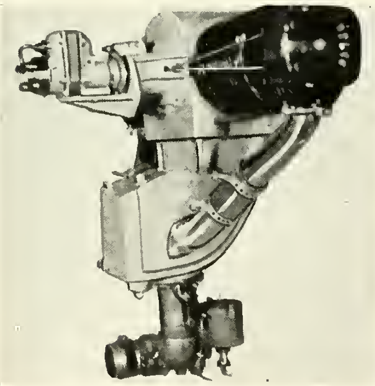
WARNER Scarab and Super Scarab

Warner Aircraft Corporation, Detroit, Michigan

• Seven-cylinder, radial, direct-drive, air-cooled. (Models Scarab and Super Scarab respectively; data on Super Scarab indicated in brackets.) Rated by the manufacturer and Department of Commerce at 125 (145) h.p. at 2050 (2050) r.p.m. ATC 2 (104). Force feed, dry sump lubrication. Compression ratio 5.2:1 (5.3:1). Bore 4.25 (4.625) in. Stroke 4.25 in. Displacement 422 (499) cu. in. Length overall (without starter) 28.875 in. Height overall 35.56 in. Bare weight 285 (300) lbs. Weight per h.p. at sea level 2.25 (2.05) lbs. Fuel consumption .55 lb./b.h.p./hr. Oil consumption .025 lb./b.h.p./hr.

Construction: Crankshaft chrome nickel steel forgings, single throw. Crankcase heat treated aluminum alloy, in two halves joined on cylinder centerline, front and rear halves each carry steel sleeve to receive crankshaft ball bearings. Main bearings are ball bearings, connecting rod bearings are high "L" head bronze. Pistons heat treated aluminum alloy, one oil, two compression piston rings to each piston. Cylinder heads heat treated aluminum alloy casting permanently shrunk and bolted to cylinder barrels. Cylinder barrels chrome molybdenum alloy steel forgings machined all over and finned. One intake, one exhaust valve.

Accessories: Scintilla magnetos, Stromberg carburetor, AC (B.G.) spark plugs. Optional equipment includes starter, oil filter, air filter, thermocouples.



WELCH O-2

Welch Aircraft Motors, Anderson, Indiana

• President, General Manager and Chief Engineer: Orin Welch. Vice-president: Gomer Welch. Sales Manager: John Welch.

Two-cylinder, opposed, direct-drive, air-cooled. Rated by the manufacturer at 45 horsepower at 2500 revolutions per minute and 41 horsepower at 2300 revolutions per minute, using 72 octane fuel. Dry sump, full pressure feed lubrication. Compression ratio 5:2. Bore 4.5 inches. Stroke 4.25 inches. Displacement 135 cubic inches. Length overall 24.5 inches. Height overall 25.5 inches. Width overall 37.75 inches. Bare weight 115 pounds. Weight in pounds per horsepower at sea level 2.4. Fuel consumption at rated horsepower .64 pounds per brake horsepower per hour. Oil consumption at rated horsepower .02 pound per brake horsepower per hour.

Construction: Crankshaft nickel steel. Crankcase aluminum alloy two piece type, mounting is by four nickel steel studs placed in the bottom of the upper crankcase. Pistons aluminum alloy trunk type with two Perfect Circle compression and one Perfect Circle oil ring to each cylinder. Cylinders are of single alloy casting including barrel, head and rocker box; bronze guides and seats are screwed and shrunk into place and a steel sleeve is shrunk and pressed into place for piston travel. New Departure bearings. Wilcox-Rich valves, one intake and one exhaust to each cylinder.

WRIGHT Cyclone R-1820F Series

Wright Aeronautical Corporation, Paterson, New Jersey

• President and General Manager: Guy W. Vaughan. Vice-president: Myron B. Gordon. Vice-president for Engineering: Arthur Nutt. Sales Manager: George Chapline. Chief Engineer: Phillip B. Taylor. Export representative: Curtiss-Wright Export Corp., 30 Rockefeller Plaza, New York City, N. Y.

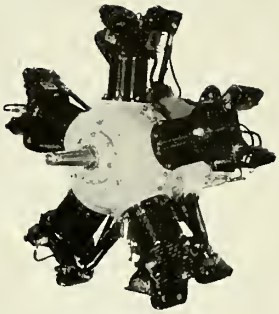
The Cyclone R-1820F series consists of seven direct drive and seven geared models, all of which are 9-cylinder, radial, air-cooled, lubricated by the full pressure dry sump method and having a bore of 6.125 in., stroke of 6.875 in., displacement of 1,823 cu. in., fuel consumption at rated h.p. of .60 lb./b.h.p./hr., and oil consumption at rated h.p. of .025 lb./b.h.p./hr. Their basic construction is identical in all other respects.

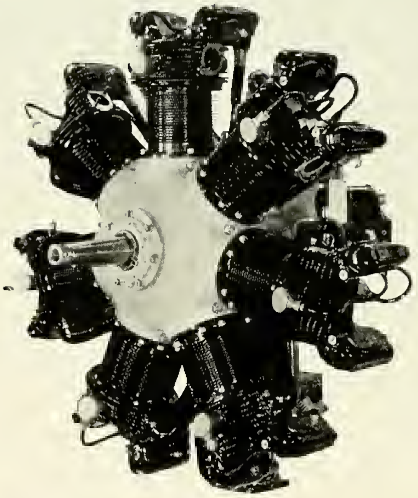
Construction: Crankshaft counterbalanced, single-throw, two piece type of chrome nickel steel forgings; runs in three bearings. Crankcase forged aluminum alloy, divided in plane of cylinders, the sections being held together by through bolts and cylinder flanges; nose section is hemispherical casting of aluminum alloy and carries the deep row ball thrust bearing, valve tappets and enclosed cam; mounting section attached to rear of main crankcase carries mounting lugs and forms front wall of diffuser chamber; supercharger impeller is mounted on plain bearings in rear section; accessories carried rear chankcase cover. Pistons are full trunk type of forged aluminum alloy; three compression, two oil control and one scraper oil rings to each cylinder; pins are full floating and are retained by snap rings to prevent scuffing of cylinder walls. Cylinder barrels are forged chrome nickel steel forgings screwed and shrunk into cast aluminum alloy heads with integral rocker support boxes; spark plugs are cooled by extending the horizontal and vertical fins of head; intake and exhaust ports face the rear. Valves are actuated through push rods and rocker arms by a cam which rides on sleeve on crankshaft in front section.

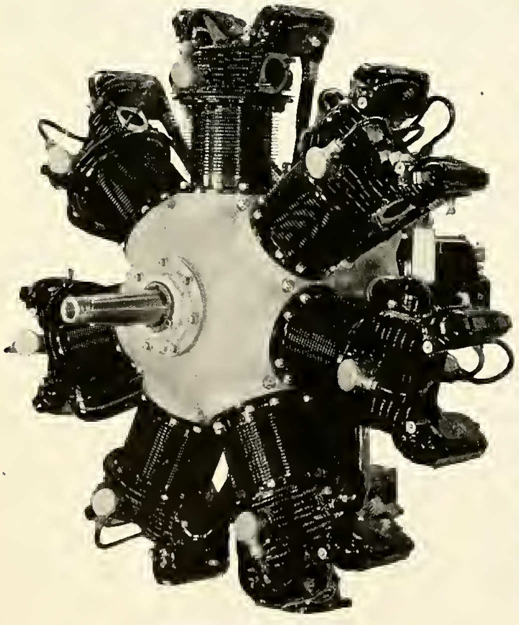
Accessories: General Electric supercharger; Scintilla magnetos, Stromberg carburetors, Eclipse starters, B. G. spark plugs, Breeze radio shielding, Romec, Evans or C3 fuel pump, Cuno oil filter, Harrison, G. & O., or United Aircraft Products oil coolers, Lewis or Weston thermocouples.

WARNER ENGINES

THE Scarab


SCARAB JR.


SCARAB


SUPER SCARAB

WHEELS

HYDRAULIC BRAKES

MECHANICAL BRAKES

COMPENSATING HYDRAULIC BRAKE CONTROL

OILDRAULIC SHOCK STRUTS

OTHER ACCESSORIES TO SPECIFICATIONS

THE WARNER AIRCRAFT CORPORATION

DETROIT, MICHIGAN

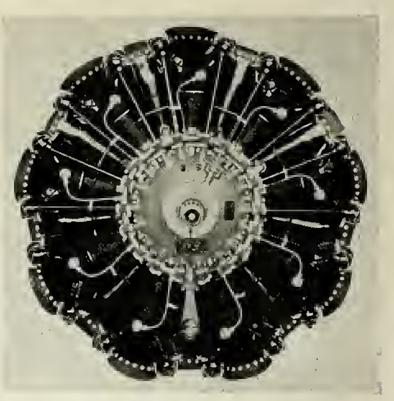
WRIGHT Cyclone R-1820F Series Direct Drive

Wright Aeronautical Corporation, Paterson, New Jersey

• The direct drive models in this series are the R-1820-F1, SR-1820-F2, SR-1820-F3, R-1820-F11, SR-1820-F32, SR-1820-F33 and R-1820-F21. They are 43.375 in. overall length and 53.75 in. overall diameter. The ratings given are those of the Department of Commerce.

R-1820-F1 is rated 715 h.p. at 1950 r.p.m., using 87 octane fuel, (ATC 89) has a compression ratio of 6.4:1 and weight of 1.31 lbs./h.p. R-1820-F11 is rated 690 h.p. at 1,950 r.p.m., uses 87 octane fuel, (ATC 97) has a compression ratio of 5.75:1 and a weight of 1.36 lbs./h.p. R-1820-F21 is rated 660 h.p. at 1,950 r.p.m., uses 73 octane fuel, (ATC 93) has a compression ratio of 5.3:1 and a weight of 1.42 lbs./h.p. These engines have a blower gear ratio of 5.95:1 and a bare weight of 937 lbs.

SR-1820-F2 is rated 735 h.p. at 1,950 r.p.m. at 4,000 ft. using 87 octane fuel, (ATC 98) has a blower gear ratio of 7:1 and a weight of 1.28 lbs./h.p. SR-1820-F3 is rated 710 h.p. at 1,950 r.p.m. at 7,000 ft. using 87 octane fuel, (ATC 103) has a blower gear ratio of 8.3:1, and a weight of 1.33 lbs./h.p. SR-1820-F32 is rated 675 h.p. at 1,950 r.p.m. at 6,500 ft., using 80 octane fuel, has a blower gear ratio of 7:1 and a weight of 1.40 lbs./h.p. SR-1820-F33 is rated 650 h.p. at 1,950 r.p.m. at 9,500 ft., using 80 octane fuel, has a blower gear ratio of 8.3:1 and a weight of 1.44 lbs./h.p. These engines have a compression ratio of 6.4:1 and a bare weight of 945 lbs.



WRIGHT Cyclone R-1820F Series Geared

Wright Aeronautical Corporation, Paterson, New Jersey

• The geared models in the R-1820F series are the GR-1820-F1, SGR-1820-F2, SGR-1820-F3, GR-1820-F11, SGR-1820-F33, GR-1820-F21, SGR-1820-F32, all having a propeller shaft ratio of 16:11, length overall of 48.125 in., and 53.75 in. overall diameter. The ratings given are those of the Department of Commerce.

GR-1820-F1 is rated 700 h.p. at 1,950 r.p.m., using 87 octane fuel, has a compression ratio of 6.4:1, and weight of 1.47 lbs./h.p. GR-1820-F11 is rated 690 h.p. at 1,950 r.p.m., uses 80 octane fuel, has a compression ratio 5.75:1 and a weight of 1.49 lbs./h.p. GR-1820-F21 is rated 660 h.p. at 1950 r.p.m. uses 73 octane fuel, has a compression ratio of 5.3:1 and a weight of 1.56 lbs./h.p. These engines have a blower gear ratio of 5.95:1 and a bare weight of 1,030 lbs.

SGR-1820-F2 is rated 750 h.p. at 1,950 r.p.m. at 2,500 ft. using 87 octane fuel, has a blower gear ratio of 7:1 and a weight of 1.38 lbs./h.p. SGR-1820-F3 is rated 710 h.p. at 1,950 r.p.m., at 7,400 ft., 87 octane fuel has a blower gear ratio of 8.3:1 and a weight of 1.46 lbs./h.p. SGR-1820-F32 is rated 650 h.p. at 1,950 r.p.m. at 6,500 ft., 80 octane fuel has a blower gear ratio of 7:1 and a weight of 1.58 lbs./h.p. SGR-1820-F33 is rated 635 h.p. at 1,950 r.p.m. at 9,500 ft., 80 octane fuel has a blower gear ratio of 8.3:1 and a weight of 1.62 lbs./h.p. These engines have a compression ratio of 6.4:1 and a bare weight of 1,038 lbs.

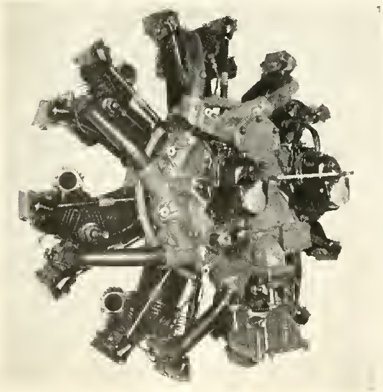
WRIGHT Whirlwind E Series

Wright Aeronautical Corporation, Paterson, New Jersey

• The Whirlwind series consists of nine engines, one 5-cylinder type, three 7-cylinder types, and five 9-cylinder types, all are radial, air-cooled, dry sump, full force feed, lubrication, with a bore of 5 inches, stroke of 5.5 inches, fuel consumption at rated h.p. of .55 lb./b.h.p./hr. Their basic construction is identical.

Construction: Crankshaft forged chrome nickel molybdenum steel; counterbalanced single throw type, in two sections to allow use of solid big-end master rod; runs in plain bronze journal bearing at rear and ball bearing at front end. Crankcase cast aluminum alloy cylindrical body with mounting bosses for cylinders; front cover carries thrust bearing; front crankshaft ball bearing carried in special section; rear accessory gears. Pistons forged aluminum alloy; one oil and three compression rings to each cylinder. Cylinder barrels forged steel with integral fins screwed and shrunk into cast aluminum alloy heads; spherical dome; exhaust ports at side provided with finned aluminum elbows; finned caps also fitted as spark plug coolers. One intake and one exhaust valve; valve gear carried in rear of main crankcase body; two-row cam ring runs on steel sleeve, concentric with crankshaft and is spur gear driven through a layshaft; roller tappets, enclosed push rods and enclosed overhead rockers operated the valves. Master rod with solid big end and steel backed anti-friction metal bearing; master and auxiliary rods of H-section; knuckle and wrist pin bushings of bronze. Carburetor carried below engine centerline supplies fuel to induction chamber in which the supercharger is housed, geared from the crankshaft; radial induction pipes convey the mixture to the inlet valves. Accessory mounting and drives are at rear of engine for fuel pump, starter, two machine gun synchronizers, two tachometer drives and generator drive. Bearings are either of the ball or roller type.

Accessories: Integral General Electric supercharger, Scintilla magnetos, Stromberg Carburetors, Eclipse starters, B. G. spark plugs, oil filter, air filter. Optional equipment includes radio shielding, fuel pump, propeller hub, booster coil and magneto.



WRIGHT Whirlwind R-540E and R-760E

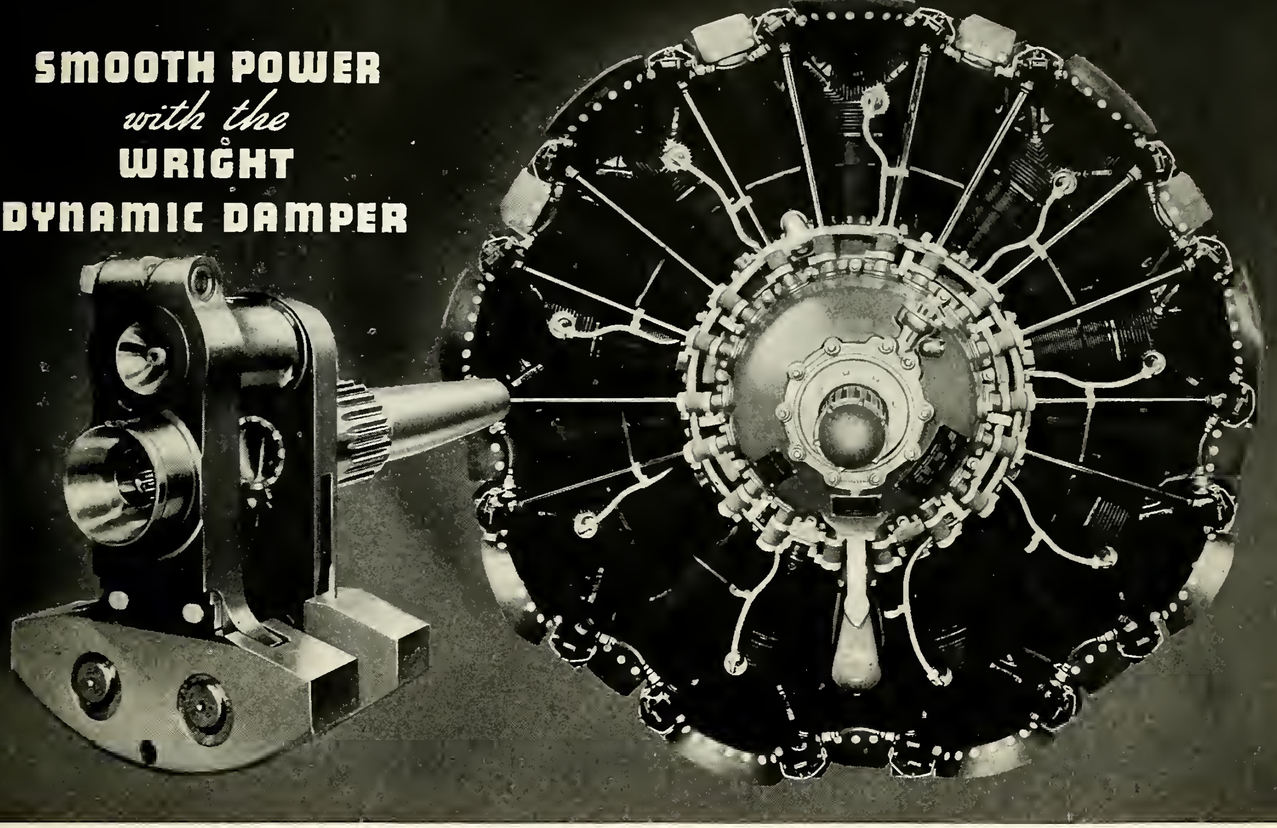
Wright Aeronautical Corporation, Paterson, New Jersey

• The R-540E is a five-cylinder radial, direct-drive, air-cooled engine rated by the Department of Commerce at 175 horsepower at 2,000 revolutions per minute (ATC 23) using 73 octane fuel. Full force feed lubrication. Compression ratio 5.1:1. Blower gear ratio 7.05:1. Bore 5 inches. Stroke 5.5 inches. Displacement 540 cubic inches. Overall length 41.09 inches. Overall diameter 45 inches. Bare weight 415 pounds. Weight in pounds per horsepower at sea level is 2.9 pounds.

The R-760 series consists of three engines, the R-760E, the R-760E-T, and the R-760E-1, seven-cylinder, radial, direct-drive engines with a bore of 5 inches, stroke of 5.5 inches, displacement of 756 cubic inches, overall length of 41.28 inches, overall diameter of 45 inches; all are full force feed dry sump lubricated and use 73 octane fuel. R-760E is rated by the Department of Commerce at 250 horsepower at 2,000 revolutions per minute (ATC 26), has a compression ratio of 5.1:1, a blower gear ratio of 7.05:1 and a bare weight of 495 pounds. R-760E-T is rated by the Department of Commerce at 235 horsepower at 2,000 revolutions per minute, (ATC 126) has a compression ratio of 6:1 and a bare weight of 500 pounds. R-760E-1 is rated by the Department of Commerce at 285 horsepower at 2100 revolutions per minute, (ATC 94), has a compression ratio of 6:1, blower gear ratio of 7.05:1 and a bare weight of 505 pounds.

The New Series F-50
WRIGHT CYCLONE

SMOOTH POWER
with the
WRIGHT
DYNAMIC DAMPER



775 H.P.

The new Series F-50 Wright Cyclone develops 775 h.p. for take-off at sea level with correspondingly high power output at high altitudes. This outstanding performance reflects the following distinctive features of design:

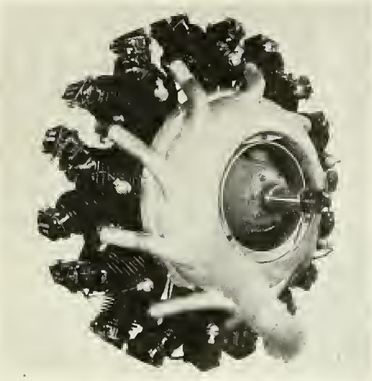
1. *Dynamic Damper,* which promotes a smoothness of operation never before attained in a radial air-cooled engine and removes engine speed restrictions throughout the operating range.
2. *Controlled Pressure Lubrication of the Valve Gear* from the engine oil system, eliminating grease and oil fittings to be serviced periodically by hand.
3. *New Cylinder Heads* with deeper and more closely spaced fins, operating under higher brake mean effective pressures, but at lower operating temperatures.
4. *Specially Treated Cylinder Barrels* with hard inner surfaces which not only appreciably lengthen the life of these parts and that of the pistons, but also reduce piston ring wear.
5. *Improved Supercharger Unit* which markedly increases supercharger efficiency both at sea level and high altitudes.

These new developments, added to the Cyclone's basic design, produce in the Wright Series F-50 Cyclone an aircraft engine unequaled in its displacement class for performance, dependability and economy of operation.

WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION



WRIGHT Whirlwind R-975E

Wright Aeronautical Corporation, Paterson, New Jersey

• The Whirlwind R-975 series consists of three direct drive engines, R-975E, R-975E-1, R-975E-2 and three geared engines, GR-975E, GR-975E-1, GR-975E-2, 9-cylinder radial, air-cooled, full force feed, dry sump lubrication with a bore of 5 in., stroke of 5.5 in., displacement of 973 cu. in., overall length of 41.87 in. overall diameter of 45 in.

R-975E is rated 330 h.p. at 2,000 r.p.m. (ATC 21 using 73 octane fuel, has a compression ratio of 5:1, blower gear ratio of 7.8:1, bare weight of 580 lbs., and weighs 1.74 lbs./h.p. R-975E-1 is rated 365 h.p. at 2,100 r.p.m. (ATC 87) using 73 octane fuel, has a compression ratio of 6:1, blower gear ratio of 7.8:1, bare weight of 595 lbs., and weighs 1.63 lbs./h.p. R-975E-2 is rated 420 h.p. at 2,150 r.p.m. (ATC 78) using 80 octane fuel, has a compression ratio of 6.3:1, blower gear ratio of 10.15:1, bare weight of 595 lbs., and weighs 1.41 pounds per horsepower. The geared engines have a ratio of 1.57:1.

GR-975E is rated 330 h.p. at 2.050 r.p.m. (ATC 21) using 73 octane fuel, has a compression ratio of 5.1:1, blower gear ratio of 7.8:1, bare weight of 630 lbs., and weighs 1.9 lbs./h.p. GR-975E-1 is rated 365 h.p. at 2,150 r.p.m. (ATC 87) using 73 octane fuel, has a compression ratio of 6:1, blower gear ratio of 7.8:1, bare weight of 645 lbs., and weighs 1.76 lbs./h.p. GR-975E-2 is rated 420 h.p. at 2,200 r.p.m. (ATC 64) using 80 octane fuel, has a compression ratio of 6.3:1, blower gear ratio 10.15:1, and a weight of 645 lbs.

WRIGHT Double-Row Whirlwind SGR-1510C-1

Wright Aeronautical Corporation, Paterson, New Jersey

• Fourteen cylinder, two-row, radial, geared, air-cooled. Rated 660 horsepower at 2400 revolutions per minute at sea level. Dry sump, pressure feed lubrication. Compression ratio 7:1. Blower gear ratio 5.95:1. Propeller gear ratio 4:3. Bore 5 in. Stroke 5.50 in. Displacement 1512 cu. in. Length overall 49.56 in. Diameter overall 45 in. Dry weight 980-995 lbs.; weight to standard specifications 1005-1020 lbs. Fuel consumption .61 lb./b.h.p./hr. Oil consumption .035 lb./b.h.p./hr.

Construction: Crankshaft, forged one piece, two throw type, supported on one ball and three roller bearings and balanced by two counterweights. Crankcase, composed of seven sections of heat treated light metal alloys; nose section aluminum alloy casting carrying valve tappet guides for front row of cylinders, the propeller thrust bearing and front cover plate; main crankcase in three sections of heat treated aluminum alloy forgings; sections held together by bolts between cylinders. Pistons high compression type machined from aluminum alloy forgings with ribs on under side of head; five piston rings to each cylinder, three compression and two oil rings; pins are of heat-treated alloy steel of the full floating type. Steel cylinder barrels screwed and shrunk into aluminum alloy heads; fins extend to front and rear of head to form integral spark plug coolers; inter-cylinder and inter-rocker baffles. Also see data in January, 1933, Aero Digest.

CURTISS Conqueror

Wright Aeronautical Corporation, Paterson, New Jersey

• The Conqueror series consists of one direct drive and three geared engines, all of which are 12-cylinder, 60° Vee, liquid cooled and have a bore of 5.125 inches, stroke of 6.250 inches, displacement of 1,587 cubic inches. Their basic construction is identical.

Construction: Crankshaft nickel chrome steel, six-throw type; runs in eight plain bearings; the direct drive engines have a ball thrust bearing placed between number seven and number eight bearings where as the geared engines have a double helical gear between number seven and number eight bearings. Crankcase aluminum, a ribbed housing is integrally cast on the geared types. Pistons forged aluminum alloy with concave heads; four piston rings to each cylinder, two compression and two oil above the piston pin. Cylinder barrels forged chrome molybdenum steel with shrunk on cast aluminum alloy heads; coolant jacket of high tensile aluminum bolted on; head has integral water and fuel passages and also provides a support for the camshaft bearings, the valve stem guides and cam follower bushings. Two intake and two exhaust valves are operated by separate overhead inlet and exhaust camshafts through T head cam followers which relieve the valve stems of side thrust. H section master and articulated rods of forged steel, auxiliary rods have bronze bushings pressed in. Auxiliary drives carried in gearcase casting at the rear of the engine for magnetos, tachometer, fuel pump, oil pump, water pump and cam drive shafts.

Both engines may be cooled by water or chemical circulated by a pump having an outlet directly to the cylinder head to avoid passing the fluid through the inlet manifold joint gasket. Lubrication is by the full force feed dry sump method with an oil seal at the front end of the crankshaft, and in the geared models a jet of oil plays on the reduction gears. The supercharged model has an integral, centrifugal type supercharger driven through a long flexible shaft and mounted in a housing cast integral with the crankcase at the rear of the engine.

Accessories include Scintilla magnetos, Stromberg carburetor, Eclipse starter, B. G. spark plugs, radio shielding, oil filter. Optional equipment includes the fuel pump.

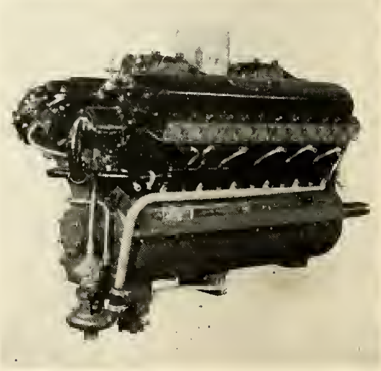
CURTISS Conqueror V-1570F

Wright Aeronautical Corporation, Paterson, New Jersey

• The direct-drive engine in the V-1570 F series is rated by the Department of Commerce at 650 horsepower at 2,400 revolutions per minute (ATC 6) using 80 octane fuel. It has a compression ratio of 6.5:1, length overall of 64 inches, height overall of 39.25 inches, a bare weight of 900 pounds, and fuel consumption at rated h.p. of .54 lb./b.h.p./hr.

The three geared engines are the GV-1570F-1, GV-1570F-2, and the SGV-1570F-4, the latter being supercharged with a blower gear ratio of 9.94:1. GV-1570F-1 is rated 625 h.p. at 2,450 r.p.m. (ATC 7) using 80 octane fuel, has a compression ratio of 6.5:1, a propeller shaft ratio of 2:1 or 7:5, length overall of 62.87 inches, height overall of 39.25 inches, bare weight of 990 lbs., fuel consumption at rated h.p. of .55 lb./b.h.p./hr. GV-1570F-2 is rated 675 h.p. at 2,450 r.p.m. (ATC 131) using 87 octane fuel, has a compression ratio of 7.25:1, propeller shaft ratio of 7.5:1, length overall of 68.87 inches, height overall of 39.125 inches, bare weight of 996 lbs., and fuel consumption at rated h.p. of .52 lb./b.h.p./hr. SGV-1570F-4 is rated 705 h.p. at 2,450 r.p.m. at 7,000 ft. (ATC 132) using 87 octane fuel, has a compression ratio of 6.5:1, propeller shaft ratio of 2:1 or 7:5, length overall of 72.67 inches, height overall of 43.54 inches, bare weight of 1,080 lbs., and fuel consumption at rated h.p. of .61 lb./b.h.p./hr.

All Conqueror engines have an overall width of 26.562 inches.



THOMPSON PRODUCTS, INC.
General Offices: Cleveland Ohio, U. S. A
Factories: Cleveland and Detroit

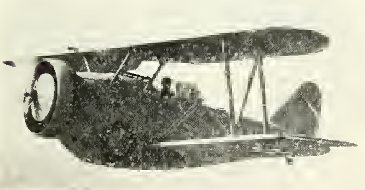
Thompson Valves

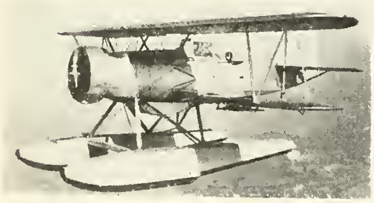
MODERN MILITARY AIRCRAFT

Curtiss Type II Hawk

Fairchild Cargo Plane

Stearman Trainer NS-1


Grumman SF-1 Scout


Curtiss Falcon Seaplane

AMBULANCE

Bellanca Senior Skyrocket monoplane, 4-place; P. & W. Wasp engine. 550 h.p.
Curtiss-Wright Condor BT-32 biplane, 14-place; 2 Cyclones....Each 715 h.p.
Fairchild XC-31 monoplane, 7-place; Wright Cyclone R-1820-F25..750 h.p.

ATTACK

Curtiss Falcon biplane, 2-place; Wright Cyclone SR-1820-F53 engine..745 h.p.
Curtiss Falcon biplane seaplane, 2-place; Wright Cyclone SR-1820-F3..715 h.p.
Curtiss Shrike monoplane, 2-place; Wright Cyclone SR-1820-F3..715 h.p.
Curtiss Shrike monoplane seaplane, 2-place; Wright Cyclone SR-1820-F2 engine ....720 h.p.
Curtiss-Wright Osprey biplane, 2-place; Wright Whirlwind engine....440 h.p.
Northrop Attack monoplane, 2-place; Wright Cyclone engine........750 h.p.
Vought V-80 biplane, 1-place; P. & W. Hornet SD engine..........675 h.p.
Vought V-90 biplane, 2-place; P. & W. Hornet SD engine..........675 h.p.
Waco WHD biplane, 2-place; Wright Whirlwind ....420 h.p.
Waco S3HD biplane, 2-place; P. & W. Wasp Junior ....420 h.p.

BOMBING (HEAVY)

Bellanca Bimotored Aircruiser land or seaplane sesquiplane, 4-place; 2 Wright Cyclone engines........Each 715 h.p.
Bellanca Aircruiser sesquiplane, 4-place; Wright Cyclone engine.......715 h.p.
Curtiss-Wright Condor BT-32 biplane, 5-place; 2 Cyclone engines. Each 715 h.p.
Hall XP2H-1 biplane flying boat; 6-place; 4 Conquerors.....Each 600 h.p.
Hall PH-1 biplane flying boat, 5-place; 2 Cyclone engines......Each 575 h.p.
Martin YB-10, Model 139-A monoplane, 4- or 5-place; 2 Wright Cyclone geared and supercharged engines. Each 675 h.p.
Martin YB-12, Model 139-B monoplane, 4- or 5-place; 2 P. & W. Hornet geared and supercharged engines. Each 650 h.p.

BOMBING (LIGHT)

Bellanca Pacemaker monoplane, 6-place; Wright R-975-E2 engine......420 h.p.

• Manufacturers of Military aircraft are listed in the inner columns of these two pages. The personnel of companies manufacturing military airplanes exclusively is given below; the personnel of the other companies listed below are incorporated with the descriptions of the civil airplanes listed on page 47 of this issue.

BELLANCA AIRCRAFT CORPORATION, New Castle, Delaware.

BOEING AIRPLANE COMPANY, Seattle, Washington.

CURTISS AEROPLANE & MOTOR COMPANY, INC., Buffalo, New York. President and General Manager: Ralph S. Damon. Vice-president: J. A. B. Smith. Sales Manager: B. S. Wright. Chief Engineer: R. R. Osborn. Export representative: J. S. Allard, Curtiss-Wright Export Corp., 30 Rockefeller Plaza, New York, N. Y.

CURTISS-WRIGHT AIRPLANE COMPANY, Robertson, Missouri.

CONSOLIDATED AIRCRAFT CORPORATION, Buffalo, New York.

DOUGLAS AIRCRAFT COMPANY, Santa Monica, California.

FAIRCHILD AIRCRAFT CORPORATION, Hagerstown, Maryland.

GREAT LAKES AIRCRAFT CORPORATION, Cleveland, Ohio.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION, Farmingdale,

●

Curtiss Shrike monoplane, 2-place; Wright Cyclone SR-1820-F3..715 h.p.
Curtiss-Wright Osprey biplane, 2-place; Wright Whirlwind engine....440 h.p.
Curtiss Hawk Type II, land or sea biplane, 1-place; Wright Cyclone SR-1820-F2 engine..............720 h.p.

Curtiss-Wright Bomber BT-32

Douglas Observation Y10-43

Boeing P-26A

OF AMERICAN MANUFACTURE

• Some of the airplanes shown in this department are military adaptations of successful commercial planes. They have found favor in the air forces of many foreign countries to which the most recent types of exclusively military aircraft used in the U. S. Army and Navy air services are not permitted to be exported.

Long Island, N. Y. President: L. R. Grumman. Vice-pres.: L. A. Swirbul. Chief Engineer: W. T. Schwendler.

HALL ALUMINUM AIRCRAFT CORPORATION, Bristol, Pennsylvania. President: C. W. Hall. Vice-president: A. H. Hall.

GLENN L. MARTIN COMPANY, Baltimore, Maryland.

NORTH AMERICAN AVIATION, INC., Dundalk, Maryland. President and General Manager: J. H. Kindelberger. Chief Engineer: J. L. Atwood.

THE NORTHROP CORPORATION, Inglewood, California.

SEVERSKY AIRCRAFT CORPORATION, Farmingdale, New York.

STEARMAN AIRCRAFT COMPANY, Wichita, Kansas.

STINSON AIRCRAFT CORPORATION, Wayne, Michigan.

CHANCE VOUGHT CORPORATION, Hartford, Connecticut. President: Eugene E. Wilson. Vice-president and Chief Engineer: Charles J. McCarthy. Asst. Chief Engineer: Rex. E. Beisel.

WACO AIRCRAFT CO., Troy, Ohio.

●

Curtiss Hawk Type III biplane, 1-place; Wright Cyclone SR-1820-F3...710 h.p.

Curtiss Goshawk, BF2C-1 biplane, 1-place; Wright Cyclone SR-1820-F3 engine........................710 h.p.

Curtiss Falcon Type 2 biplane, 2-place; Wright Cyclone SR-1820-F3...710 h.p.

Curtiss II Falcon land or sea biplane, 2-place; Cyclone SR-1820-F3...710 h.p.

Vought V-90 biplane, 2-place; P. & W. Hornet SD engine...........675 h.p.

Waco WHD biplane, 1-place; Wright Whirlwind ....420 h.p.

Waco S3HD biplane, 1-place; P. & W. Wasp Junior ....420 h.p.

BOMBING (DIVING)

Great Lakes BG-1. Navy Department prohibits publication of data on this model.

BOMBING (SCOUT)

Bellanca Skyrocket monoplane, 4-place; Wright Cyclone engine.......715 h.p.

CARGO

Bellanca Aircruiser sesquiplane, 2-place; Wright Cyclone engine.......715 h.p.

Curtiss-Wright Condor CT-32 biplane, 2-place; 2 Wright Cyclone SGR-1820-F2 engines.............Each 750 h.p.

Fairchild XC-31 monoplane, 1-place; Wright Cyclone engine.......715 h.p.

FIGHTING

Boeing F4B-4 biplane Navy carrier, 1-place; P. & W. Wasp supercharged engine ....500 h.p.

Boeing 281 monoplane, 1-place; P. & W. Wasp Series SE engine......550 h.p.

Consolidated P-30 monoplane, 2-place; Curtiss Conqueror engine.

Curtiss Hawk Type I biplane, land or sea, 1-place; Cyclone SR-1820-F2..720 h.p.

Curtiss Shrike monoplane, 2-place; Wright Cyclone SR-1820-F3..715 h.p.

Curtiss Goshawk BF2C-1 biplane, 1-place; Wright Cyclone SR-1820-F3 engine ....710 h.p.

Grumman FF-1 biplane Navy carrier, 2-place; Wright Cyclone engine.700 h.p.

Vought V-80 biplane, 1-place; P. & W. Hornet SD engine...........675 h.p.

Vought V-90 biplane, 2-place; P. & W. Hornet SD engine...........675 h.p.

Waco WHD biplane, 2-place; Wright Whirlwind ....420 h.p.

Waco S3HD biplane, 2-place; P. & W. Wasp Junior ....420 h.p.

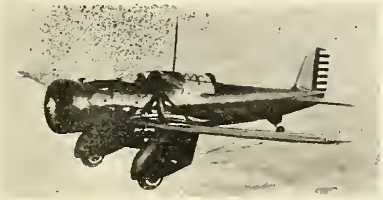
Curtiss Type III Hawk

Northrop Attack

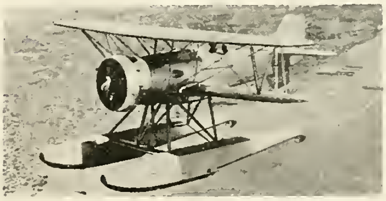
Bellanca Pacemaker Scout-Bomber

Consolidated Trainer

Boeing 4FB-4 Fighter



Curtiss Shrike A-12



Curtiss Hawk Seaplane Fighter

North American Observation OJ-2

Vought Corsair V-100

Martin Bomber YB-10

Bellanca Cargo Aircruiser

OBSERVATION

Bellanca 28-70 monoplane, 2-place; Hispano-Suiza engine ....860 h.p.

Curtiss Shrike seaplane monoplane, 2-place; Wright Cyclone SR-1820-F2 engine.......................720 h.p.

Curtiss Shrike monoplane, 2-place; Wright Cyclone SR-1820-F3..715 h.p.

Curtiss Falcon seaplane biplane, 2-place; Cyclone SR-1820-F3 engine...715 h.p.

Curtiss Falcon biplane, 2-place; Wright Cyclone SR-1820-F53 engine.745 h.p.

Curtiss Raven O-40B monoplane, 2-place; Wright Cyclone SR-1820-F2..720 h.p.

Curtiss-Wright Osprey biplane, 2-place; Wright Whirlwind R-975-E3..440 h.p.

Douglas O-43 monoplane, 2-place; Curtiss Conqueror engine............650 h.p.

North American OJ-2 biplane, land or sea, 2-place; P. & W. engine..400 h.p.

Vought Corsair biplane, land or sea, 2-place; P. & W. Wasp engine.

Vought V-90 biplane, 2-place; P. & W. Hornet SD engine...........675 h.p.

Waco WHD biplane, 2-place; Wright Whirlwind ....420 h.p.

Waco S3HD biplane, 2-place; P. & W. Wasp Junior ....420 h.p.

PATROL

Consolidated P2Y-1J sesquiplane flying boat; two pilots and varying payload; 2 Wright Cyclone geared engines. Each 700 h.p.

Douglas OA-4B amphibion monoplane, 6-place; 2 P. & W. Wasp S1D1 engines..................Each 450 h.p.

Hall PH1 biplane flying boat, 5-place; 2 Cyclone engines......Each 700 h.p.

PURSUIT

Bellanca 28-70 monoplane, 2-place; Hispano-Suiza engine...........860 h.p.

Boeing P-26A monoplane, 1-place; P. & W. Wasp supercharged engine.550 h.p.

Curtiss Hawk Type I biplane, land or sea, 1-place; Cyclone SR-1820-F2..720 h.p.

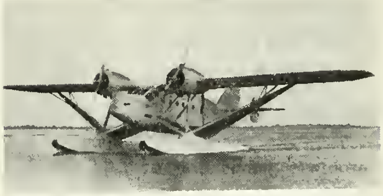
Curtiss Hawk Type II seaplane biplane, 1-place; Cyclone SR-1820-F3..715 h.p.

Curtiss Hawk Type II biplane, 1-place; Cyclone SR-1820-F3 engine...715 h.p.

Curtiss Hawk Type III seaplane biplane, 1-place; Cyclone SR-1820-F3..715 h.p.

Curtiss Hawk Type III biplane, 1-place; (retractable landing gear); Wright Cyclone SR-1820-F3 engine...715 h.p.

Curtiss Hawk Type IV biplane, 1-place; (retractable landing gear); Wright Cyclone SR-1820-F3 engine...715 h.p.


Bellanca Bimotored Bomber

Douglas Dolphin OA-3

Hall Aluminum Patrol PH-1

Consolidated Patrol Flying Boat

Hall Aluminum Patrol Bomber XP2H-1

Curtiss-Wright Osprey biplane, 2-place; Wright Whirlwind R-975-E3..440 h.p.

SCOUTING

Grumman SF-1 biplane, 2-place; Wright Cyclone engine ....715 h.p.

Vought Corsair Navy carrier biplane, 2-place; P. & W. Hornet engine.675 h.p.

TRAINING

Consolidated Model 11 biplane, 2-place; Kinner R-5 engine...........160 h.p.

Consolidated Model PT-11C biplane, 2-place; Wright Whirlwind R-760E engine ....240 h.p.

Curtiss-Wright Primary Trainer Model 16 WJ biplane, 2-place; Warner Scarab Junior engine.................90 h.p.

Curtiss-Wright Advanced Trainer Model C-14-D-T biplane; 2-place; Wright Whirlwind engine............225 h.p.

Curtiss-Wright Trainer Model 16E biplane, 2-place; Wright Whirlwind engine .... 175 h.p.

Curtiss Wright Advanced Trainer Model C-14-B9 biplane, 2-place; Wright Whirlwind engine............300 h.p.

Great Lakes 2T-1A biplane, 2-place; Cirrus engine...................100 h.p.

Seversky SEV-3XAR monoplane; 2-place; Wright Whirlwind or Wasp Junior engine.

Stearman NS-1 biplane, 2-place; Wright Whirlwind R-790 engine.....220 h.p.

Stinson Senior Trainer monoplane, 2-place; Lycoming R-680 engine.225 h.p.

Vought Junior V-100 biplane, 2-place; Wasp Junior engine.........400 h.p.

Waco WHD biplane, 2-place; Wright Whirlwind ....420 h.p.

Waco S3HD biplane, 2-place; P. & W. Wasp Junior ....420 h.p.

TRANSPORT

Bellanca Skyrocket monoplane, 6-place; P. & W. Wasp engine........550 h.p.

Bellanca Aircruiser sesquiplane, 12-place; Wright Cyclone engine.......715 h.p.

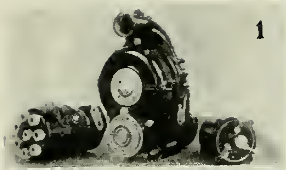
Curtiss-Wright Condor BT-32 biplane, 24-place; two Cyclones..Each 715 h.p.

Fairchild XC-31 monoplane, 16-place; Wright Cyclone R-1820-F25..750 h.p.

UTILITY

Grumman JF-1 amphibion biplane, 2- or 3-place; Wright Cyclone......735 h.p.

Grumman JF-2 amphibion biplane, 2- or 3-place; P. & W. Twin Wasp..750 h.p.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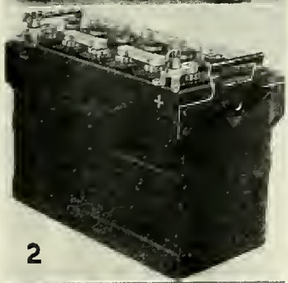
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The group of accessories in this section shows typical units in production for aircraft and engines. In every case it does not include the complete line of each manufacturer, but is representative of the products they make available to the aeronautical industry. The pictorial presentation herewith indicates the wide variety of modern appliances and unit parts made in the United States now in current use.

PLANE AND ENGINE ACCESSORIES AND THEIR MANUFACTURERS

AIR FILTERS:

Air-Maze Corporation,
Caxton Building, Cleveland, O.

BATTERIES:

Burgess Battery Co., Freeport, Ill.
The Electric Storage Battery Co.,
Allegheny Ave., Philadelphia, Pa.
Gould Stor. Batt. Co., Depew, N. Y.
Philadelphia Storage Battery Co.,
Ontario & C Sts., Phila., Pa.
Prest-O-Lite Storage Batt. Corp.,
Indianapolis, Indiana.
U. S. L. Battery Corporation, 1800
Highland, Niagara Falls, N. Y.
Willard Storage Battery Company,
274 E. 131st St., Cleveland, Ohio.
Wubco Storage Battery Company,
Niagara Falls, New York.

BEARINGS:

American Non Gran Bronze Corp.,
Berwyn, Pennsylvania.
Amplex Manufacturing Company,
7900 Jos Campau, Detroit, Mich.
Bantam Ball Bearing Company,
South Bend, Indiana.
Berium Bearing, Incorporated,
261 Franklin St., Boston, Mass.
Bound Brook Oilless Bearing Co.,
Bound Brook, New Jersey.
Bunting Brass & Bronze, Toledo, O.
The Fafnir Bearing Company,
New Britain, Connecticut.
Federal Bearings Company, Inc.
Poughkeepsie, New York.
Fisher Ball Bearing Corporation,
33 W. 60 Street, New York, N. Y.
Gwilliam Company,
360 Furman St., Brooklyn, N. Y.
Marlin Rockwell, Jamestown, N. Y.
New Departure Manufacturing Co.,
Bristol, Connecticut.
Norma-Hoffman Bearings Corp.,
Stamford, Connecticut.
SKF Industries, Inc., Phila., Pa.
Schatz Bearing, Poughkeepsie, N.Y.
Timken Roller Bearing, Canton, O.

CABLE: (Structural)

Aero Supply Corp., Corry, Pa.
American Cable Company,
230 Park Av., New York, N. Y.
American Steel & Wire Company,
208 S. LaSalle St., Chicago, Ill.
Barbour-Stockwell Company,
205 Broadway, Cambridge, Mass.
Belden Cable & Rope Company,
4647 W. Van Buren, Chicago, Ill.
General Cable Corporation, 420
Lexington Av., New York, N. Y.
Hazard Wire Rope Co.,
230 Park Av., New York, N. Y.
Macwhyte Company, Kenosha, Wis.
John A. Roebling's Sons Company,
Trenton, New Jersey.
Titeflex Metal Hose Company,
Frelinghuysen Av., Newark, N. J.
United Aircraft Products, Inc.,
Dayton, Ohio.

CAMERAS: (Aerial)

Abrams Aerial Survey Corporation,
W. Allegan St., Lansing, Mich.
Aero Service Corporation,
1612 Chancellor St., Phila, Pa.
Bell & Howell Company,
1801 Larchmont Av., Chicago, Ill.
Burleigh Brooks, 127 W. 42 St., N.Y.
Eastman Kodak Company,
343 State St., Rochester, N. Y.
Fairchild Aerial Camera Corp.,
Woodside Av., Woodside, N. Y.
Folmer Graflex Corporation,
154 Clarrissa, Rochester, N. Y.
E. Leitz Co., 60 E. 10 St., N. Y. C.
Skyview Camera Company,
Municipal Airport, Cleveland, O.

CARBURETORS:

Holley Carburetor Company,
Vancouver Ave., Detroit, Mich.
Zenith Carburetor, Detroit, Mich.

GEARS & SPROCKETS:

Boston Gear Works, Quincy, Mass.
Ex-Cell-O Aircraft & Tool Co.,
Oakman Blvd., Detroit, Mich.
Meisel Press Manufacturing Co.,
Dorchester Av., Boston, Mass.

COLLECTOR RINGS, COWLS, STREAMLINES:

American Tube Bending Company,
New Haven, Connecticut.
Brewster Aeronautical Corporation,
Brewster Bldg., L. I. City, N. Y.
Buhl Stamping Company,
2730 Scotten Av., Detroit, Mich.
Curtiss Aeroplane & Motor Co., Inc.,
Buffalo, New York.
Engle Aircraft Specialties,
1729 Standard Av., Glendale, Cal
Fleetwings, Inc., Bristol, Pa.
G & O Mfg. Co., New Haven, Conn.
General Sheet Metal & Welding,
Roosevelt Field, Mineola, N. Y.
Hill Aircraft Streamliners Co.,
814 Reedy St., Cincinnati, Ohio.
Magosy & Buscher,
120 Walker St., New York, N. Y.
Solar Aircraft Company, Limited,
Lindbergh Field, San Diego, Cal.

CONTROLS:

Aero Supply Mfg. Corp., Corry, Pa.
Arens Controls,
West Marquette Rd., Chicago, Ill.
Brewster Aeronautical Corporation,
Brewster Bldg., L. I. City, N. Y.
Shakespeare Products Company,
Kalamazoo, Michigan.

Illustrations on this page: 1—Scintilla radio shielded timer and tri-motor switch. 2—Exide aircraft battery. 3—Arens vernier control. 4—SKF roller bearings. 5—Fafnir bearings. 6—Norma-Hoffmann ball and roller bearings. 7—Fairchild camera gun. 8—Fairchild aerial camera. 9—Hill streamline wheel fairing. 10—Skyview aerial camera. 11—Scintilla equipment for battery ignition. 12—Pyrene aircraft-type fire extinguisher. 13—Shakespeare spark control. 14—Solar engine exhaust stack.

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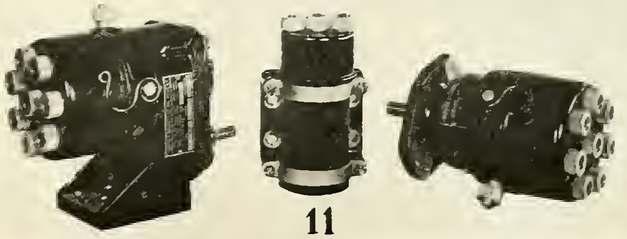
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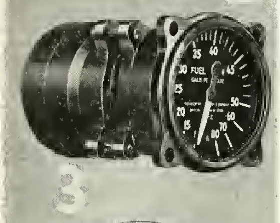

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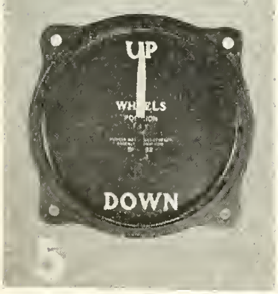

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CONTROL STICKS AND WHEELS:

American Hard Rubber Company, 11 Mercer St., New York, N. Y.
Bloxham Aero Manufacturing Co., 7541 Emerald Av., Chicago, Ill.
Lobdell Emery Mfg. Co., Alma, Mich.

ELECTRICAL EQUIPMENT:

Eclipse Aviation, E. Orange, N. J.
The Electric Storage Battery Co., Allegheny Av., 19 St., Phila., Pa.
Walter Kidde & Company, Inc., 140 Cedar St., New York, N. Y.
Leece-Neville Company, 6363 Hamilton Av., Cleveland, O.
Littlefuse Laboratories, 1772 Wilson Av., Chicago, Ill.
Scintilla Magneto Co., Sidney, N.Y.
United American Bosch Corp., Springfield, Massachusetts.

ELECTRICAL SWITCHES:

Bull Dog Electric Products Co., Jos Campau Av., Detroit, Mich.
Cannon Electric Development, W. Avenue 33, Los Angeles, Cal.
Cutler Hammer Company, 12th & St. Paul, Milwaukee, Wis.
Eclipse Aviation, E. Orange, N. J.
Harvey Hubbell & Company, Inc., Bridgeport, Connecticut.
Kellogg Switchboard & Supply, 1066 West Adams, Chicago, Ill.
Pass & Seymour, Incorporated, Solvay Station, Syracuse, N. Y.
Union Switch & Signal Company, Swissvale, Pennsylvania.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania.

FASTENERS:

Dzus Fastener Company, Babylon, Long Island, New York.
United-Carr Fastener Corporation, 31 Ames St., Cambridge, Mass.

FIRE EXTINGUISHERS:

American LaFrance & Foamite Corp., Elmira, New York.
Badger Fire Extinguisher Company, 123 William St., New York, N.Y.
Buffalo Fire Appliance Corporation, 44 Central Av., Buffalo, N. Y.
Dayton Fire Ext. Co., Dayton, O.
Firemaster Company, 682 Sixth Av., New York, N. Y.
Flamex, Inc., Denver, Colorado.
Flash Fire Ext. Co., Dayton, Ohio.
Fyr-Fyter Company, Dayton, O.
Phister Manufacturing Company, 901-03 Broadway, Cincinnati, O.
Pyrene Manufacturing Company, 560 Belmont Av., Newark, N. J.
Robinson Fire Apparatus Mfg. Co., 4250 North 12 St., St. Louis, Mo.
Stempel Fire Extinguisher Mfg. Co., Ferry Street, St. Louis, Mo.

FITTINGS:

Aerial Machine & Tool Corp., 260 West St., New York, N. Y.
Aero Supply Mfg. Corp., Corry, Pa.
The Cleveland Pneumatic Tool Co., 3734 E. 74 St., Cleveland, Ohio.
Dayton Mfg. Co., Dayton, Ohio.
Husband Aircraft Specialties, 6545 Carnegie Av., Cleveland, O.
Imperial Brass Manufacturing Co., 524 S. Racine Av., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
National Steel Products, Dayton, O.
John A. Roebling's Sons Company, Trenton, New Jersey.
Solar Aircraft Company, Limited, Lindbergh Field, San Diego, Cal.

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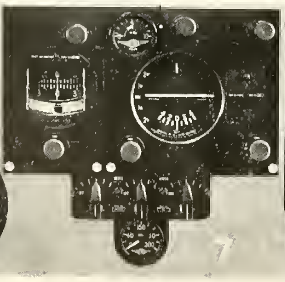

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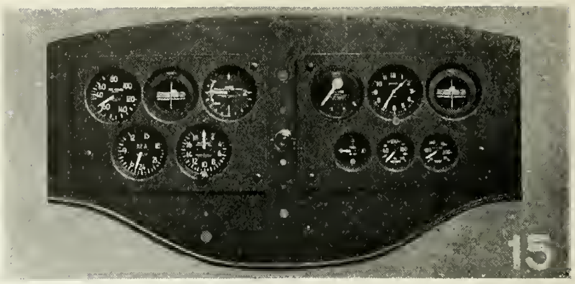

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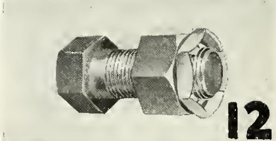

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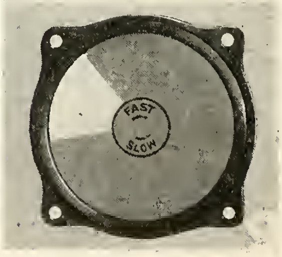

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Steel Products Engineering Co., Springfield, Ohio.
Stewart-Warner Corporation, Alemite Division, Chicago, Ill.
Weatherhead Company, 632 Frankfort Av., Cleveland, O.

FITTINGS:
(Fuel and Oil Line)

Aero Supply Mfg. Co., Corry, Pa.
Amer. Brass Co., Waterbury Conn.
Husband Aircraft Specialties, 6545 Carnegie Av., Cleveland, O.
Lunkenheimer Co., Cincinnati, O.
Parker Appliance Company, 10320 Berea Rd., Cleveland, O.
Titeflex Metal Hose Company, Frelinghuysen Av., Newark, N. J.
United Aircraft Products, Inc., Dayton, Ohio.

FLARES: (Signal)

International Flare Signal Co., Tippecanoe City, Ohio.
J. C. Newman & Company, Inc., 2 E. 45 Street, New York, N. Y.

FLOATS, SKIS, ETC.:

Seymour J. Baum, 49 Mill St., Astoria, L. I., N. Y.
Brewster Aeronautical Corporation, Brewster Bldg., L. I. City, N. Y.
Edo Aircraft Corporation, College Point, Long Island, N. Y.
Federal Aircraft Works, 69 S. 13 St., Minneapolis, Minn.
Fleetwings, Inc., Bristol, Pa.
The Warner Aircraft Corporation, 20263 Hoover Av., Detroit, Mich.

GASKETS:

Garlock Pack. Co., Palmyra, N. Y.
Goetz Gasket & Packing Company, New Brunswick, New Jersey.
McCord Radiator & Mfg. Company, Detroit, Mich.
The Vellumoid Co., Worcester, Mass.
Victor Manufacturing & Gasket Co., 5750 Roosevelt Rd., Chicago, Ill.

HOSE CLAMPS:

Aero Supply Mfg. Corp., Corry, Pa.
The Cleveland Pneumatic Tool Co., 3734 E. 78 St., Cleveland, Ohio.
Ideal Clamp Manufactng. Co., Inc., 200 Bradford St., Brooklyn, N. Y.
Wittek Manufacturing Company, 4300 W. 24 Place, Chicago, Ill.

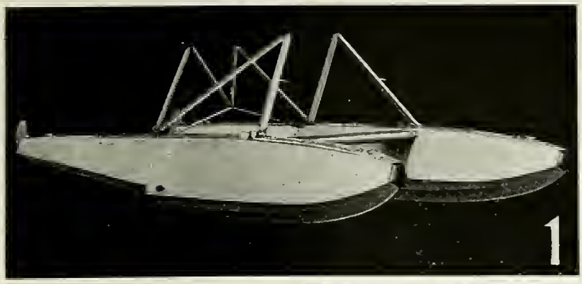
IGNITION SWITCHES:

Scintilla Magneto, Sidney, N. Y.
United-American Bosch Corp., Springfield, Massachusetts.

INSTRUMENTS:

Abrams Aerial Survey Corp., 119 Allegan St., Lansing, Mich.
Aerial Machine & Tool Corporation, 260 West Street, New York, N. Y.
Aero Instrument Company, 3678 W. 138 St., Cleveland, O.

1—Pioneer Autosyn indicator. 2—Weston electrical tachometer. 3—Pioneer Autosyn fuel flow indicator. 4—Kollsman vertical speed indicator. 5—Pioneer wheel position indicator. 6—Sperry gyro-horizon. 7—Sperry directional gyro, bank and climb gyro, oil pressure gauge. 8—Sperry directional gyro. 9—Weston engine synchronizer. 10—Pyle National landing light. 11—Kollsman sensitive altimeter. 12—Palnut lock-nut. 13—General Electric tachometer. 14—Pyle National wing light. 15—Aeromarine instrument panel.



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INSTRUMENTS—Continued

Aeromarine Instrument Co., Inc.,
370 Gerard Av., New York, N. Y.
Air Associates, Incorporated,
Garden City; Chicago; Glendale.
American Paulin System,
Maple Av., Loa Angeles, Cal.
Barbour-Stockwell Company,
205 Broadway, Cambridge, Mass.
Boston Auto Gage,
28 Clapp Ave., Pittsfield, Mass.
G. Bouchard Co., Kalamazoo, Mich.
Cons. Ashcroft Hancock Company,
Bridgeport, Connecticut.
Elgin Nat'l Watch Co., Elgin, Ill.
Foxboro Co., Foxboro, Mass.
Frisbie Aircraft Products, 161
Edgewood Av., New Haven, Conn.
General Electric Company,
Schenectady, New York.
Jaeger Watch Company,
304 East 45 St., New York, N. Y.
Johnson Airplane & Supply,
Vandalia, Ohio.
Kenyon Instrument Company,
564 E. 1st St., S. Boston, Mass.
Kollsman Instrument Co., Inc.,
1 Junius Street, Brooklyn, N. Y.
Leeds & Northrop Company,
4901 Stenton Av., Phila., Pa.
The Lewis Engineering Company,
Naugatuck, Connecticut.
MotoMeter Gauge & Inst. Corp.,
La Crosse, Wisconsin.
New Haven Clock Company,
New Haven, Connecticut.
Pacific Scientific Company,
1206 Maple Av., Los Ang., Cal.
Pioneer Instrument Company, 754
Lexington Av., Brooklyn, N. Y.
Rieker Instrument Company,
Fairmount Av., Philadelphia, Pa.
E. S. Ritchie & Sons,
112 Cypress St., Brookline, Mass.
Shore Instrument & Mfg. Co.,
Van Wyck Av., Jamaica, N. Y.
Sperry Gyroscope Company,
Man. Bridge Pl., Bklyn., N. Y.
Star Compass Co.. E. Milton, Mass.
Taylor Inst. Co., Rochester, N. Y.
Waltham Clock Co., Waltham, Mass.
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pennsylvania.
Weston Electrical Instrument Co.,
Newark, New Jersey.

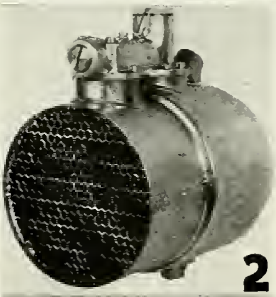
MAGNETOS:

Berling Magneto Co., Buffalo, N. Y.
Scintilla Magneto, Sidney, N. Y.
United - American Bosch Corp.,
Springfield, Massachusetts.

NAVIGATION AND LANDING LIGHTS:

Air Transport Equipment Company,
Roosevelt Field, Mineola, N. Y.
The Corcoran-Brown Lamp Co.,
Cincinnati, Ohio.
Lights, Incorporated,
Avalon Blvd., Los Angeles, Cal.
Grimes Electric, Schenectady, N. Y.
Grimes Manufacturing Company,
Urbana, Ohio.
The Pyle-National Company,
N. Kostner Av., Chicago, Ill.
S. & M. Lamp Company,
118 W. 36 St., Los Angeles, Cal.

1—*Edo twin floats.* 2—*United Aircraft oil radiator.* 3—*International parachute flares.* 4—*Pyle National landing light.* 5—*Eclipse instrument pump.* 6—*Motor improvements oil filter.* 7—*Lycoming-Smith controllable pitch propeller.* 8—*Curtiss metal propeller.* 9—*Gardner wood propeller.* 10—*Curtiss anti-drag ring.* 11—*Air Associates magneto shields and wiring harness.* 12—*Warner ski.* 13—*Ohio aluminum pistons.* 14—*Irving parachutes.* 15—*Switlik seat pack parachute.*



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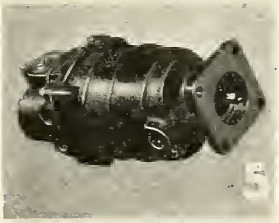

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NUTS, BOLTS, ETC.:

Aero Supply Mfg. Corp., Corry, Pa.
Chicago Screw Company,
1026 S. Homan Av., Chicago, Ill.
Dardelet Threadlock Corporation,
120 Broadway, New York, N. Y.
Elastic Stop Nut Corporation,
Elizabeth, New Jersey.
Milford Rivet & Machine Company,
Milford, Connecticut.
The Palnut Company,
319 Coit St., Irvington, N. J.
Parker-Kalon Corporation,
200 Varick St., New York, N. Y.
Judson L. Thompson, Waltham,
Massachusetts.

OIL FILTERS:

AC Spark Plug Co., Flint, Mich.
The Cuno Engineering Corporation,
Meridan, Connecticut.
Motor Improvements, Incorporated,
Frelinghuysen Av., Newark, N. J.

OIL RADIATORS:

Engle Aircraft Specialties,
1729 Standard Ave., Glendale, Cal.
The G. & O. Manufacturing Co.,
New Haven, Connecticut.
Harrison Radiator Corporation,
Lockport, New York.
McCord Radiator & Mfg. Corp.,
Detroit, Michigan.
United Aircraft Products, Inc.,
Dayton, Ohio.

PARACHUTES:

Follmer, Clogg Co., Lancaster, Pa.
Irving Air Chute Company,
1670 Jefferson Av., Buffalo, N. Y.
Switlik Parachute & Equip. Co.,
Broad & Dye Sts., Trenton, N. J.
Triangle Parachute Company,
4917 Carthage Av., Cincinnati, O.

PISTONS, PISTON PINS:

Aluminum Indus., Cincinnati, O.
Bohn Aluminum & Brass Company,
E. Grand Blvd., Detroit, Mich.
Ohio Piston Ring Co., Cleveland, O.
Sealed Power Corporation,
Muskegon, Mich.
Thompson Prod., Cleveland, Ohio.

PISTON RINGS:

Amer. Hammered Piston Ring Co.,
Bush & Hamburg St., Balti., Md.
Ohio Piston Rings Co., Cleveland.
Perfect Circle Co., Hagerstown, Ind.
Sealed Power Corporation,
Muskegon, Mich.
Simplex Piston Ring Sales Co.,
Cleveland, Ohio.
U. S. Hammered Piston Ring Co.,
Paterson, New Jersey.

PROPELLERS:

Burnelli Aircraft, Keyport, N. J.
California Propeller Company, Ltd.,
W. Slauson Av., Los Ang., Cal.
Curtiss Aeroplane & Motor Co., Inc.,
Buffalo, New York.
Eclipse Aviation Corp. (hubs),
East Orange, New Jersey.
Flottorp Propeller Company,
Linden Av., Grand Rapids, Mich.
Gardner Propeller Company,
Circle Av., Forest Park, Ill.
Hamilton Standard Propeller Co.,
East Hartford, Connecticut.
Hartzell Propeller Co., Piqua, O.
Lycoming-Smith Manufactur. Co.,
Williamsport, Pennsylvania.
Marshall - Fahlin Propeller Co.,
English at North, Marshall, Mo.
Pittsburgh Screw & Bolt Corp.,
Pittsburgh, Pennsylvania.
Sensenich Brothers, Lititz, Pa.
Stone Propeller Co., Wichita, Kan.
Story, Gawley Company,
San Fernando Rd., Glendale, Cal.
Supreme Propeller, Wichita, Kan.

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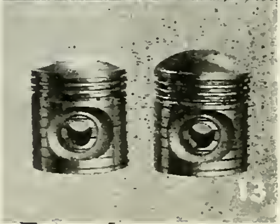

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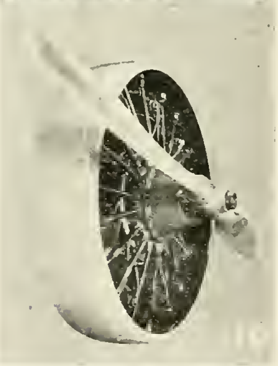

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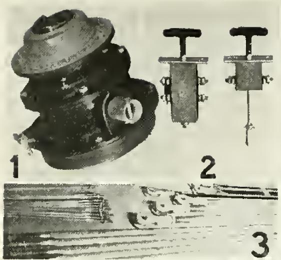

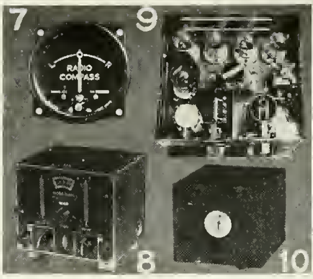

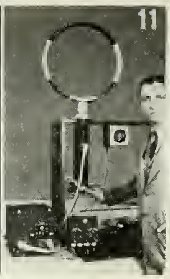

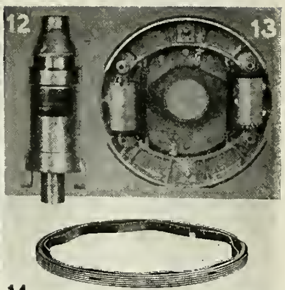

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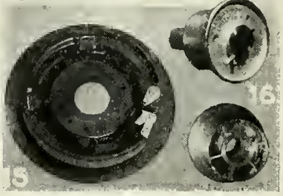
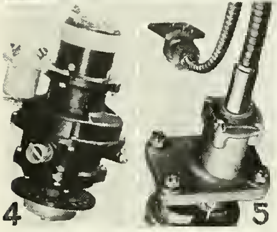




PULLEYS: (Control)

Formica Insulation Company,
Spring Grove Av., Cincinnati, O.
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pennsylvania.

PUMPS: (Fuel, Oil & Air)

Aero Supply Mfg. Corp., Corry, Pa.
Eclipse Aviation, E. Orange, N. J.
The Evans Appliance Company,
Vinewood Ave., Detroit, Mich.
Romec Pump Co., Elyria, Ohio.
United Aircraft Products, Inc.,
Dayton, Ohio.

RADIOS:

Aeronautical Radio Company,
Roosevelt Field, Mineola, N. Y.
Aircraft Radio Corp., Boonton, N. J.
Crosley Radio Corp., Cincinnati, O.
Lear Developments, Incorporated,
125 W. 17 St., New York, N. Y.
Radiomarine Corp. of America,
66 Broad St., New York, N. Y.
RCA Manufacturing Company, Inc.,
Camden, New Jersey.
Simplex Elec., Indianapolis, Ind.
Western Electric Company,
195 Broadway, New York, N. Y.
Westinghouse Elec. & Mfg. Co.,
East Pittsburgh, Pennsylvania.
Westport Manufacturing Company,
San Fernando Rd., Glendale, Cal.

RADIO COMPASSES:

Fairchild Aerial Camera Corpn.,
Woodside Av., Woodside, N. Y.
Lear Developments, Incorporated,
125 W. 17th St., New York, N. Y.

RADIO SHIELDING & EQUIPMENT:

Air Associates, Incorporated,
Garden City, Chicago, Glendale.
Aircraft Radio Corp., Boonton, N. J.
Breeze Corporation, Newark, N. J.
Engle Aircraft Specialties,
1729 Standard Av., Glendale, Cal.
Littlefuse Laboratories,
1772 Wilson Av., Chicago, Ill.
Packard Electric Co., Akron, O.
Trimm Radio Manufacturing Co.,
1528 Armitage Av., Chicago, Ill.

SAFETY BELTS:

Aerial Machine & Tool Corporation,
260 West St., New York, N. Y.
Air Associates, Incorporated,
Garden City, Chicago, Glendale.
Buffalo Weaving & Belting,
Chandler St., Black Rock, N. Y.
Russell Mfg. Co., Middletown, Conn.
Switlik Parachute & Equip. Co.,
Broad & Dye Sts., Trenton, N. J.

SHOCK STRUTS:

Automotive Fan & Bearing Co.,
Fern & Wildwood, Jackson, Mich.
Bendix Aviation Corporation,
South Bend, Ind.
The Cleveland Pneumatic Tool Co.,
3734 E. 78 St., Cleveland, Ohio.
Kirkham Engineer. & Mfg. Corp.,
Farmingdale, Long Island, N. Y.
The Warner Aircraft Corporation,
20263 Hoover Ave., Detroit, Mich.

SPARK PLUGS:

AC Spark Plug Co., Flint, Mich.
The B. G. Corporation,
136 W. 52 St., New York, N. Y.
Champion Sp. Plug Co., Toledo, O.
Edison Splitdorf Company,
West Orange, N. J.
Hurley - Townsend Corporation,
305 E. 45 St., New York, N. Y.
Mosler Ignition Corporation,
345 Hudson St., New York, N. Y.

STARTERS:

The Cleveland Pneumatic Tool Co.,
3734 E. 78 St., Cleveland, Ohio.
Eclipse Aviation Corporation,
East Orange New Jersey.

TIE RODS:

Breeze Corporation, Incorporated,
24 S. Sixth St., Newark, N. J.
Stewart Hartshorn Company,
250 Fifth Ave., New York, N. Y.
Macwhyte Company, Kenosha, Wis.

TIRES & TUBES

Firestone Tire & Rubber Company,
Akron, Ohio.
General Tire & Rubber Company,
Akron, Ohio.
B. F. Goodrich Co., Akron, Ohio.
The Goodyear Tire & Rubber Co.,
Akron, Ohio.
U. S. Rubber Company,
1790 Broadway, New York, N. Y.

TUBING: (Flexible & Copper)

Amer. Brass Co., Waterbury, Conn.
Chase Brass & Copper,
Waterbury, Conn.
B. F. Goodrich Co., Akron, Ohio.
The Goodyear Tire & Rubber Co.,
Akron, Ohio.
Seamlex Corporation,
5-19 48 Av., L. I. City, N. Y.
Stempel Fire Extin. Mfg. Company,
Ferry Street, St. Louis, Mo.
Titeflex Metal Hose Company,
Frelinghuysen Av., Newark, N. J.

VALVES:

Aluminum Industries, Cincinnati, O.
Jadson Motor Products Company,
8354 Wilcox Avenue, Bell, Cal.
Thompson Products, Cleveland, O.
Wilcox-Rich Corp., Cleveland, O.

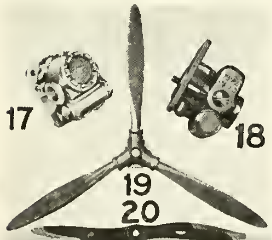
WHEELS & BRAKES:

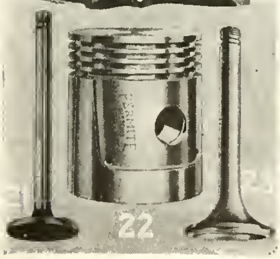
Aircraft Prod. Corp. of America,
7424 Melville Ave., Detroit, Mich.
Automotive Fan & Bearing Co.,
Jackson, Michigan.
Bendix Aviation Corporation,
South Bend, Indiana.
Dayton Wire Wheel Company,
Miami Chapple Rd., Dayton, O.
The Goodyear Tire & Rubber Co.,
Akron, Ohio.
Kelsey - Hayes Wheel Company,
3600 Military Av., Detroit, Mich.
Shinn Devices Corporation,
P'tsb'gh-Butler Airp't, Butler, Pa.
Variety Manufacturing Company,
West 3 St., Dayton, O.
The Warner Aircraft Corporation,
20263 Hoover Av., Detroit, Mich.

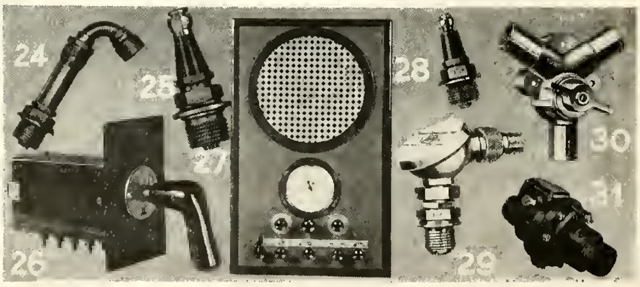
MISCELLANEOUS:

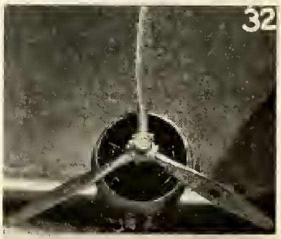
American Steel & Wire Company,
208 S. LaSalle St., Chicago, Ill.
(electrical cable)
Eclipse Aviation, E. Orange, N. J.
(engine starters, generators, etc.)
Fink-Dumont-White, Inc.,
Lafayette St., New York
(protective fuel tank caps)
General Electric, Schenectady, N. Y.
(superchargers)
Lord Manufacturing, Erie, Pa.
(rubber mounts for engines, etc.)
Packard Electric Corp., Warren, O.
(electrical cable)
John A. Roebling's Sons Company,
Trenton, New Jersey.
(electrical cable)
Russell Mfg. Co., Middletown, Conn.
(landing gear shock cord)
Warner Aircraft, Detroit, Mich.
(hydraulic brakes, control units)
S. S. White Dental Mfg. Co.,
211 S. 12th St., Phila., Pa.
(flexible drive shafts)

1—Eclipse hand inertia starter. 2—Eclipse equipment control switches. 3—Macwhyte tie rods. 4—Eclipse hand and electric starter. 5—S. S. White flexible drive shaft. 6—Lear radio compass. 7—Weston radio compass indicator. 8—Western Electric 17A aircraft receiver. 9—Westinghouse aircraft receiver. 10—Crosley aircraft receiver. 11—Fairchild Kreusi radio compass. 12—Cleveland Pneumatic Aerol shock strut. 13—Warner aircraft brake. 14—Simplex piston ring. 15—Autofan mechanical brake. 16—Shinn Devices wheel. 17—Evans fuel pump. 18—Romec fuel pump. 19—Lycoming-Smith three-bladed controllable pitch propeller. 20—Sensenich Bros. wood propeller. 21—Aluminum Industries engine valve. 22—Aluminum Industries piston. 23—Thompson engine valve. 24—B. G. shielded spark plug. 25—Champion spark plug. 26—Westinghouse control switch. 27—RCA receiver. 28—B. G. spark plug. 29—Hurley-Townsend shielded spark plug. 30—Lunkenheimer oil drain. 31—Weston magneto generator. 32—Hamilton-Standard three-bladed controllable-pitch propeller. 33—Hamilton-Standard controllable-pitch propeller hub.









Personairlities

Cy Caldwell

● BERNT BALCHEN, the famous Norwegian-American pilot, has spent a large part of his life acting as nurse to various innocent promoters of Polar Publicity Expeditions, such as Admiral Byrd, Sir Hubert Wilkins, and Lincoln Ellsworth. Those gentlemen do a great work in gathering together the financial and physical sinews of polar exploration, and without their promotional efforts no expeditions would be possible. They snare such well-stuffed money-bags as Jake Ruppert and Charley Bob—when he was in the money—and in payment name boats and mountains after them. But once the boat leaves the dock, the real work of the Leaders is over, and they may sit down and let the other boys do the actual exploring, flying, digging up fossils, and looking for coal that nobody wants.

It is then that such unheralded gentry as Bernt Balchen take control and guide the lavishly publicized gent into the paths where he should go in order to get material for his lectures when he returns, and stuff to put into the books that ghost-writers will grind out under his name. Bernt is one of the small army of practical and scientific men who perform the real work; and for them I hold a high respect: they have to battle, not only the Arctic snow and cold, but also the temperamental and publicity-hunting prima donnas for whom they labor, and they have no easy task of it. They go, not for the money and the honor, both of which they are denied, but for the joy of exploration, which delights such simple and curious fellows.

Bernt Balchen, one of the finest of a most admirable brotherhood of self-effacing and honest explorers, was born Oct. 23, 1899, in Tveit Topdal, Norway, and educated at the public and high schools, military school, Government Forestry School, and the Military Aviation School in Norway. Then he went to Harnosand in Sweden, to the *Techniska Skogs och Saagverks Skolan,* and was graduated when he could pronounce the name of the school without stumbling. That's why these Norwegians and Swedes always do well when they come to the United States; they've had such an intensive mind training merely learning their own language that it naturally makes them smarter than the rest of us. For instance, the other day at lunch in the Hotel Gotham, New York, Bernt was explaining a new system of weather forecasting and aerial navigation to a little group of us, which included such intellectual navigational whales as Emil Burgin, Bob Lyon, and Clyde Pangborn. In his first sentence Bernt left me behind, and in his second he had outdistanced the entire field and was going it alone. The American navigators kept on nodding their heads, as though they understood what he was saying, but they didn't fool me: I knew that was only an involuntary nervous reflex, that their heads were nodding automatically, and that nothing in the way of information was going into them.

Bernt Balchen

Not that it does him any good, but Bernt is generally credited with more flying over ice and snow than any other pilot. It simply happened that where he flew as flight lieutenant in his service with the Royal Artillery and Air Service in his native Norway, until 1926, there was more ice and snow than there was good arable land, so he flew over what lay beneath, and made the best of it. In 1925 he served as pilot on the Amundsen-Ellsworth Relief Expedition to Spitzbergen, and in May, 1926 was a member of the Amundsen-Nobile-Ellsworth Arctic Expedition which flew to the Pole, when a landing was made at Teller, Alaska, after the *Norge* had flown 3,000 miles in 71 hours. Here Bernt got his first introduction to the essential pettiness and jealousies of all Polar Promoters, for a controversy immediately arose, with both Lincoln Ellsworth and Amundsen claiming credit for leadership of the expedition. As if it mattered! If you can't attend a lively Wednesday afternoon session of the Ladies' Aid Society when all the girls say what they actually think about each other, just go on a Polar Expedition and you'll experience the same back-biting and general cattiness. A main difference between members of the Ladies Aid and Polar Publicity Explorers is that the latter speak bass or tenor and wear furs.

In 1927 Balchen was with the Hudson Bay Expedition and co-pilot with Floyd Bennett on the Round-the-States flight. He acted as pilot on the trans-Atlantic flight of the *America* to call Wanamaker's store to the attention of the public; there were other pilots aboard, but Bernt did the flying. He usually does, no matter who signs the press stories. During 1928-1930 he served as chief pilot for the Byrd Antarctic Expedition, carrying America's Sweetheart over the Antarctic and bringing him safely back again to receive the plaudits of the throng. In recognition of his services in ferrying around a character as popular as Mickey Mouse, we made Bernt an American citizen in Nov. 1931, and now he's in the same boat as the rest of us. That's gratitude for you!

In March, 1931, Bernt was one of three pilots comprising a search expedition for the members of the sealing ship *Viking,* destroyed by an explosion off the Newfoundland coast while engaged in movie work. The movie people aboard were all saved. Balchen came back and got into more useful work as test pilot and aeronautical engineer for General Aviation Corp. at Hasbrouck Heights. Here he could look at Tony Fokker free of charge, instead of having to pay a fee if they had put Tony in a circus. Tony thinks I should be in a circus, too, (in the monkey cage), so we're even in our estimate of each other, and no hard feelings on either side. It's wonderful when you see two men agree about each other like that.

In August Bernt went to Europe to look over the airlines and learn things—he's the darndest student you ever saw, always searching for information, and seldom finding any. In the spring of 1932 he rebuilt Amelia Earhart's Lockheed and flew that charming and really delightful lady to Newfoundland for her trans-Atlantic solo flight. Incidentally, while regarding some of Amelia's over-water exploits with a somewhat jaundiced eye, I regard the lady herself with warm admiration. She'll sniff at that; but I don't often say what I don't mean.

In April, 1932, Balchen signed a contract with Lincoln Ellsworth to tuck him up and wheel him around the Antarctic in a Northrop plane for his greater glory and content. They left Norway in July, 1933, on the *Wyatt Earp,* named after a Western gunman for some reason that escapes me. On the way to New Zealand they stopped at Cape Town, South Africa, where Bernt disembarked his appendix and was off to sea five days later. They left Dunedin Dec. 3 for the Bay of Wales and were stuck in the pack ice for 22 days, but landed Jan. 7, 1934, and set up the Northrop, intending to make flights on skis from there. Although the ice was 20 feet thick, it suddenly broke up early one morning, dropping the Northrop between two floes. Frenzied work on the part of Balchen and others resulted in the ship, partly crushed, being hoisted to the deck of the *Wyatt Earp,* disassembled, and stowed away for shipment back to Los Angeles for rebuilding. It arrived in March, 1934, was rebuilt in two months, and sent to New Zealand again in July. After several test flights, Bernt flew Mr. Ellsworth around Deception Island in December and January, but I don't see that it did either of them any good. I mean, whether you deceive yourself by flying around Deception Island or Coney Island, what does it matter?

Anyhow, Bernt is back and looking for a job. I hope that he's through with this Frigid Foolishness and will get down to business and do some work that will be profitable to himself and the rest of aviation. We in America shouldn't let this old Norwegian-American go off to Norway to run a sort of aerial cod-liver oil line, which I hear is in prospect.

* * *

● AS THE signing of the Declaration of Independence and the birth of Arthur L. Caperton would undoubtedly prove too much for a frenzied nation to celebrate on the same day, Nature wisely hurried the latter catastrophe and had the infant Arthur ready for inspection a day ahead, July 3, 1898, at Pueblo, Colorado. Arthur left Pueblo and was raised in Richmond, Virginia, which gave him that high Southern polish and culture that now enables him to circulate among our native aristocracy and landed gentry. He is at present adding to the social charm of the *Alva,* William K. Vanderbilt's sea-going yacht, by acting as pilot of Mr. Vanderbilt's Douglas Amphibion which is carried on the yacht's after-deck.

Skipper Art Caperton

The accompanying photograph, snapped by the Society Editor of this department, discloses the well-known man-about-docks and *bon vivant* in a moment of leisure aboard the *Alva* or a Weehawken ferry, we don't know which. Anyhow it's some sort of boat, for that thing behind Mr. Caperton is an anchor, not a bottle-opener, as some of our readers who are not in society might imagine. In our Upper Set we use anchors as well as bottle-openers, and the well-dressed man may be photographed beside either without causing comment or disturbing his *savoir faire* or *san fairy ann,* as we Society reporters with a knowledge of French would say.

Getting back reluctantly to Mr. Caperton's humble beginnings, he started work during the early stages of the war in the Dupont and Winchester arms plants. The social life there was positively crude; and it was only slightly more refined on the sub-chasers in which Mr. Caperton served the U. S. Navy. Sub-chasers are generally considered rather low, even by Navy chappies in submarines; so it is not surprising to learn that our impending sub-deb forsook the Navy and all its ways in April, 1918, and started out to become a Military Aviator. He went through the Ohio State University Ground School and completed his ground training at Princeton University. It was here, where the sainted Woodrow Wilson held sway in his earlier days, that Mr. Caperton first learned some of the odd ways of Society, being startled to discover that peas should not be eaten off a knife, unless mashed, and that the spoon should be held firmly against the rim of the cup with the index finger before the coffee is raised to the lips—all of which appeared meaningless and rather sissy to him at the time. However, he persevered in his pursuit of culture and, after flight training at Park Field, Memphis, was demobilized in March, 1919, with R.M.A. rating, ready to take his place as a social butterfly.

What one man casts away another picks up; what the Army unfeelingly demobilized, the Marine Corps was glad to commission Second Lieutenant, and Arthur Caperton was sent to Marine Flying Field, Miami, Fla. Art was attached to squadrons at Parrish Island, S. C., until June, 1921 when he became pilot for Aeromarine Airways for a season, flying New York to Atlantic City and around about. Then he became a flying cadet again in the Army Air Corps—he told them he'd just been slumming with the Marines—and was rated Airplane Pilot, Air Corps, in December, 1923. This gave him enough social standing to associate with Casey Jones at Curtiss, Garden City, for six months, when he joined Gulf Coast Air Lines and flew Curtiss Sea Gulls and M-F boats on the New Orleans-Pilottown contract route for a year, returning in March, 1924, to fly for Curtiss at Atlantic City and Garden City until Jan., 1927, when he flew seaplanes for William B. Leeds in the South Seas, ending in Tahiti, Society Islands. Art says they were doing exploring. I can imagine the kind of exploring Art and Bill Leeds would do.

Then Art returned in April, 1927, and spent the next two years exploring around Garden City for the Curtiss Co., then to China for Curtiss, surveying the present air mail and passenger routes there. He only stayed six months, which isn't long enough to enable a white man to distinguish one Chinaman from another. I've sometimes wondered if we all look alike to the Chinese, as they do to us. They're a great people, the Chinese: apparently any nation at all can conquer China, but if the invaders stay there a couple of centuries they simply disappear—the Chinese marry them, and in 200 years they're all Chinks together. Then a new lot of foreigners storm in and capture everything, and get married, and disappear in their turn. This sort of thing has been going on for thousands of years; it's really getting monotonous. The latest race to start the vanishing act is the Japanese; having tan hides to begin with they'll probably disappear in about a hundred years, setting a speed record.

He came back in June, 1929, flew for Curtiss until October, then flew a Sikorsky amphibion the next three years for Public Service Co. of Northern Illinois, until Feb., 1932. He flew for American Airlines on various routes during the next two years: Cleveland-Fort Worth, St. Louis-Louisville-Indianapolis, New York-Boston passenger and mail runs. Since July, 1934, he has been with Mr. Vanderbilt, who just floats around the world on the *Alva* and hops aloft in the Douglas whenever he gets tired of the yacht. My old school teacher used to tell me about

(*Continued on page* 144)

AIRLINES AND AIR TRAVEL

New Schedules Operating

AMERICAN AIRLINES is now operating sleeper-plane service on the New York-Cleveland-Dallas line with Curtiss-Wright Condors formerly on the New York-Chicago route. Operating with new Vultee transports, the company is offering faster schedules between Dallas and Chicago saving 20 minutes over former schedules. In addition, a new night passenger flight is available between these two cities, the route being by way of Memphis and St. Louis with a connection at the former with Chicago and Southern Airlines.

Tyler, Tex., was reinstated on the air mail map and is now being served by Delta Air Lines which is using the newly improved airport there; Chicago and Southern Air Lines inaugurated overnight air mail service between Fort Worth and New Orleans, as well as between Chicago and New Orleans when the lighted airway between Jackson and St. Louis was completed.

Eastern Air Lines opened a new 7-hour 30-minute flight between Chicago and New Orleans in Douglas planes, increased the number of trips between New York and Washington to 10 and switched its transports on the New York-New Orleans route from night to day operations. Capt. E. V. Rickenbacker, general manager reported that the 10 flights between New York and Washington are spaced 90 minutes apart, with one exception, and begin at New York at 8:10 in the morning and continue until 10:10 at night.

New fast passenger and mail schedules were inaugurated by Northwest Airlines, between Chicago and the Twin Cities and the company is preparing to start an additional round-trip service between Chicago and Seattle upon completion of the lighted airway. Service will be operated by Lockheed Electra transports.

A fourth round trip daily between Detroit and Washington, and a fifth round trip between Detroit and Cleveland were put into operation by Pennsylvania Airlines, and Western Air Express started a new flight between Salt Lake City and Los Angeles following the acquisition of another Boeing transport; six more pilots and two stewardesses were employed recently by the company.

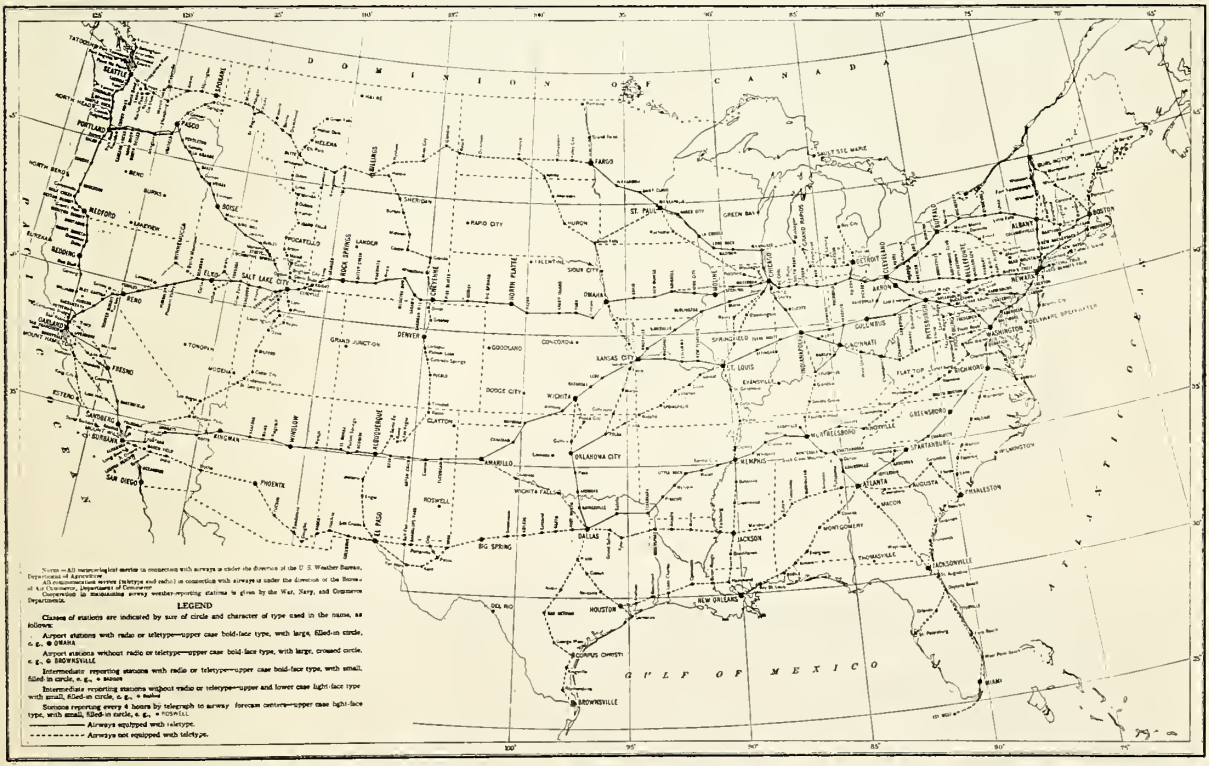
A round-the-world service utilizing air transport for part of the distance was announced by United Air Lines; passengers leave Seattle by air, take a steamer at New York, arrive in Cherbourg during the morning hours and reach Budapest the same evening. The itineraries are arranged in advance of the passengers' departure. With coordination of schedules with Hanford Air Lines, the company inaugurated all multi-motored service from Kansas City to San Francisco, Portland, Seattle, and other points on the west coast, with both overnight and daylight schedules being made available to air passengers.

Pan American Speeds Alaska Line

SEVEN-HOUR SCHEDULES between Juneau and Nome are to go into effect by Pacific Alaska Airways Pan American Airways' subsidiary, when new Lockheed Electra transports begin flying over a route which ordinarily requires 34 days by surface travel.

A 700-mile airway is to be established between Fairbanks and Juneau, following up the Klondike Trail to Whitehorse, Yukon Territory to Tanana Crossing and thence into central Alaska.

Pacific Alaska Airways has established radio and weather stations over the main routes throughout the territory, has constructed or improved airports and intermediate fields, and has made other improvements to facilitate service over these routes.



NOTES.—All meteorological service in connection with airways is under the direction of the U. S. Weather Bureau, Department of Agriculture.

All communication service (teletype and radio) in connection with airways is under the direction of the Bureau of Air Commerce, Department of Commerce.

Cooperation in maintaining airway weather-reporting stations is given by the War, Navy, and Commerce Departments.

LEGEND

Classes of stations are indicated by size of circle and character of type used in the name, as follows:

Airport stations with radio or teletype—upper case bold-face type, with large, filled-in circle, e. g., ● OMAHA

Airport stations without radio or teletype—upper case bold-face type, with large, crossed circle, e. g., ⊕ BROWNSVILLE

Intermediate reporting stations with radio or teletype—upper case bold-face type, with small, filled-in circle, e. g., • BADGER

Intermediate reporting stations without radio or teletype—upper and lower case light-face type with small, filled-in circle, e. g., • Bushnell

Stations reporting every 4 hours by telegraph to airway forecast centers—upper case light-face type, with small, filled-in circle, e. g., • ROSWELL

———— Airways equipped with teletype.

- - - - - - Airways not equipped with teletype.

Airway map showing location of radio and teletype stations disseminating weather information and maintaining a communicating service

Personnel Changes

FOLLOWING THE resignation of L. Edwin Gill as traffic manager of Eastern Air Lines, Capt. E. V. Rickenbacker, general manager, announced the appointments of Paul Brattain to that position, of Goodrich Murphy as northern divisional traffic manager and of John K. Ottley as southern divisional traffic manager. Other appointments included Don C. McRae as chief communications engineer and Edmund T. Allen as chief engineer.

Arthur G. Beggs formerly general traffic manager of Western Air Express became western traffic manager for America Airlines, and W. H. Hottel was employed in the traffic division of Transcontinental & Western Air in Los Angeles, while Ole May was appointed district traffic agent in St. Louis at the same time that C. H. Fredericksen and C. E. Caldwell took the positions of city traffic representative and transport agent respectively.

Pat O'Malley rejoined the publicity staff of American Airlines in New York.

6,455 Persons in Air Service

STATISTICS ISSUED by the Bureau of Air Commerce of the Department of Air Commerce revealed that as of January 1, 1935, American operated airlines both domestic routes and extensions to foreign countries employed 6,455 persons of whom 503 were pilots, 248 were co-pilots, 2,201 were mechanics and ground crew men, and 1,846 were hangar and field employees. In addition there were 1,657 employees engaged in operations work and in offices.

These lines had in service 518 airplanes which consumed 25,136,274 gallons of fuel and 838,756 gallons of oil.

Williams Joins Express Group

WITH THE enrollment of Wedell-Williams Air Service Corporation in the General Air Express system, there are now nine air transport companies in the group, according to Rogers M. Combs, Jr., chairman of the Interline System. Bowen Air Lines recently became a member, thus providing Texas cities with extended express coverage.

Wedell-Williams operates between New Orleans and Houston, with stops at Baton Rouge and Beaumont.

AT THE AIRPORTS

New Companies Formed

FOLLOWING CESSATION of operations by the Curtiss-Wright Airport Corp., at Hadley Airport, New Brunswick, N. J., Hadley Airport, Inc., was formed to continue activities there under a lease agreement. Thomas W. Robertson is president; N. A. Yuckman, vice-president; and W. H. Swain, secretary. Operations will be continued on aircraft sales, storage, repair, and service work.

Sooner State Aircraft Inc. was granted a charter of incorporation to do business in Oklahoma City. Incorporators are M. S. Crosley, O. E. Allbaugh and L. S. Crowl.

Pampa Airport Corp., of Pampa, Tex., also was granted a charter. Officers are B. L. Hoover, R. C. Allen, and C. P. Buckler.

Operators Move Quarters

CINCINNATI AIRCRAFT Service has moved from Watson Airport to Hangar 2, Lunken Municipal Airport, Cincinnati, according to Elmer Schmidt. The company offers service and storage facilities, instruction, charter work, sales, and an approved repair agency.

Increasing business forced the H. C. Robbins Company to move to the Austin Building at the Cleveland Municipal Airport where it will continue to act as distributor for Waco aircraft, and provide service on aircraft and engines, and storage facilities. In addition, it has been appointed exclusive sales representative for the Skyview Aerial Camera Co.

Engle Aircraft Specialties is now in a new shop which provides 5000 square feet of floor space where metal work will be manufactured. The company formerly was located at the Grand Central Air Terminal in Glendale, Calif., and in its new location will be a short distance from the field.

Airport Improvements

AIRPORTS IN at least eleven states are contemplating improvements which would provide more acceptable flying conditions and better facilities for the increasing number of private, commercial and air transport operators.

The Junior Board of the Chamber of Commerce of Monroe, La., has endorsed proposals to equip Selman Airport near the city to conform to the requirements of the Department of Commerce. Equipment necessary includes boundary lights, and a flasher beacon which together with other improvements will cost about $10,000. At St. James, Mo., a new hangar has been completed at the municipal airport, and Palatka, Fla., has just started improving its municipal field.

One of the contemplated municipal projects in Baltimore, Md., is the completion of the airport at Dundalk at a cost of $1,700,000; the Texas legislature has a bill which if passed will enable the city of Fort Worth to issue $125,000 in revenue warrants as security for a Federal loan to complete the municipal airport which needs a lighting system and other improvements. Improvements of a substantial character have been proposed by the Board of Aviation Commissioners for the Paul Baer Municipal Airport in Fort Wayne, Ind. These include the construction of a new repair building, and new paved parking areas.

Little Rock, Ark., will close the street running through a portion of its municipal field, thus ending a controversy which resulted in partial suspension of airline activities; Twin Falls, Idaho is being developed, and application has been made for funds for building an administration building at the Buffalo Municipal Aviation Center.

Work is beginning on an airport at Pulaski, Va., to provide an intermediate field on the Washington-Nashville airline route, the field having been chosen two miles from the city. It will be equipped with boundary, obstruction lights and radio facilities. Following completion of improvements of runways at the Springfield, Mo., municipal airport air mail service was resumed there.

Personnel Changes

WILLIAM GRAVES is now managing the Tri-City Airport in Wisconsin Rapids, Wisconsin following the signing of a one-year lease. Graves will provide flying instruction to members of the newly-formed Wisconsin Rapids Flying Club which is planning to purchase a plane.

After an absence of several months, Howard Mays returned to Chesapeake, Ohio, from Dayton to assume charge of the port of which he formerly was manager.

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ACTIVITY AT THE SCHOOLS

Personnel Changes

THE RYAN School of Aeronautics has appointed E. W. Schmuck, instructor in charge of aircraft maintenance and repair, and at the same time announced that his brother Charles, who has been associated with him in aircraft activities for a number of years, has entered the production department of the Ryan Aeronautical Co. Both have extensive flying experience and are holders of transport licenses.

Since Nelson Grace took over the metal department at the Curtiss-Wright Technical Institute of Aeronautics, rapid strides have been made. The curriculum has been revised, 40 hours added to the course and the space occupied by the department doubled in size. This school also announced the appointment of Herbert Rawdon to the faculty of the engineering school. Rawdon will be the third member of the engineering school which is headed by C. Stryker.

Increased enrollment in the Casey Jones School of Aeronautics has necessitated the addition of Harold Fisher, George Caldwell and Nicholas Kintzer to the faculty.

Enrollments Increased

THE MARCH class of the Casey Jones School of Aeronautics numbered 36 students bringing the total enrollment to 305, of whom 157 are registered in the day school.

The large student enrollment at the Ryan School of Aeronautics has made it necessary to purchase another Great Lakes plane for primary and advanced instruction.

With 10 students enrolled, 5 students soloed and 8 receiving Department of Commerce licenses, Joe Plosser, operator of the Grand Central Flying School, Grand Central Air Terminal, Glendale, Calif., reports one of the school's biggest months of busines since its opening.

Following the introduction of an aeronautical course in the Mississippi State College, almost 160 students registered for the beginning of the present session and from present indications enrollments will substantially increase during the 1935-1936 session. Courses are given in aircraft design, construction and maintenance, welding, rigging, engine overhaul and trouble shooting.

New Courses Available

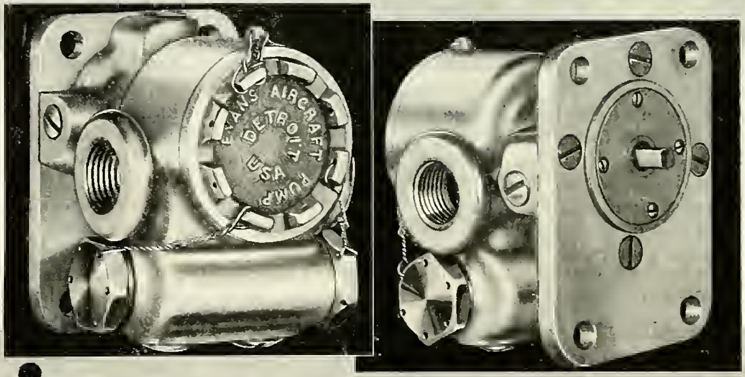
NOTRE DAME University, South Bend, is establishing a course in aviation following a conference with aviation officials. It has been decided to provide instruction in metallurgy, internal combustion engines, streamlining and other basic constructional problems.

The recent development of commercial air transport in Latin American countries was responsible for the introduction of a course in Spanish at Parks Air College. The aeronautical engineering school there is now recognized and accredited by the State of Illinois as a technical institution.

A master mechanics course will be made available by Pennsylvania Technical Institute, Hughesville, Pa. The course will be for 2 years, the second half of which will provide the student practical instruction in an aircraft factory. The students at this school are at present building a light plane and expect to have it ready to fly by May.

Relief projects for 1935 in Wisconsin may include free ground school work for those interested in aviation, according to a report which states Governor LaFollette is investigating the matter. The School of Engineering in Milwaukee has offered the equipment and instruction.

DEPENDABILITY



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THE AIR SERVICES

Officers In New Posts

COL. CHARLES A. Pursley has assumed his duties as control officer of the Southwestern Division at Fort Sam Houston, San Antonio, Texas. Capt. Victor A. Byrnes, medical officer, has been transferred from Fort Crockett, Galveston, to Barksdale Field, Shreveport.

Lieut. Col. Jacob B. Fickel of Washington has assumed command of the advanced flying school at Kelly Field, San Antonio, relieving Lieut. Col. Henry B. Clagett, who goes on a leave of absence before reporting to his new post in the office of the Chief of the Air Corps in Washington.

Reserves Learn Blind Flying

EIGHTEEN REGULAR Army instructors on duty with National Guard air squadrons throughout the United States are to assemble at Rockwell Field for a special two weeks course in blind flying. The course has been established on the recommendation of the Chief of the National Guard Bureau and is in line with the present policy that all air units of the National Guard should be thoroughly trained and equipped for flying under all weather conditions.

As a result of their instruction in the blind flying course the instructors will become acquainted with the latest methods and developments in equipment.

Examining Board Appointed

MEMBERSHIP OF the board of Army officers to conduct the forthcoming final examination of qualified flyers for appointment as second lieutenants in the Regular Army Air Corps April 2 at Mitchel Field, Hempstead, L. I., was announced by Major General Dennis E. Nolan, U. S. Army, commanding the Second Corps Area, with headquarters on Governors Island.

The examining board will consist of Maj. Claude W. Cummings; Maj. Walter M. Crandall; Capt. Shiras A. Blair; Capt. Walter J. Reed; and Lieut. John N. Jones.

Practical flying tests will be given all candidates who have not served as pilots on active or extended active duty as Army Air Corps Reserve officers within two years. Eligibility to compete is confined to qualified flyers who have not reached the age of 29 years nine months, who fulfill the necessary qualifications for appointment as second lieutenant in the Regular Army, have served a minimum of twelve months on active or extended active duty as pilots with a tactical unit of the Air Corps, have efficiency ratings of satisfactory or above for every period of such duty, and are physically qualified for flying.

Third Attack Group Moves

WHEN COLONEL Gerald C. Brant, now Commanding Officer of the Third Wing, landed at Fort Crockett, Galveston, Tex, and issued orders for the immediate removal of the 3rd Attack Group to Barksdale Field, it climaxed two years of waiting on the part of the personnel of the Group, who expected to move to that field upon its completion.

An advance detachment departed from Fort Crockett by air on the morning of Feb. 19th, and the ferrying of the Attack Group's airplanes began at the same time. The initial ferry flights were led by 2nd Lieuts. K. R. Crosher for the 8th Attack Squadron, F. E. Calhoun for the 13th and G. M. Murchison for the 90th. The advance party was strengthened by additional men during the week following, the necessary equipment being transported by air.

All of the A-12's training planes and other aircraft of the Group were immediately transferred to the new station, with the exception of planes on maneuvers, others temporarily out of commission, and one command plane. Transports of the organizations were in continuous use between the two stations.

Trophies Awarded

VN SQUADRON 2D8, attached to the U. S. Naval Air Station, Pensacola, Fla., won the Herbert Schiff Trophy competition for the fiscal year 1934.

The trophy award is made annually to the naval aviation squadron which flies the greatest number of hours, maintaining the highest standard of safety.

VN Squadron 2D8, the successful squadron in attaining the highest merit for hours flown with a minimum number of accidents was under command of Lt. L. A. Moebus, USN, during the competition year and in order to attain first place completed some ten thousand flying hours with only three very minor accidents.

The Mackay Trophy for 1934 has been awarded by the War Department to Brig. General Henry H. Arnold, Air Corps, in recognition of his leadership as Commanding Officer of the U. S. Army Alaskan Flight of last year. Gen. Arnold also was the first winner of the Mackay Trophy in 1912, when as a Lieutenant, 29th Infantry, detailed to the Aviation Section of the Signal Corps, he made a reconnaissance flight from College Park, Md., then the site of the Signal Corps Aviation School, over the triangle Washington Barracks, D. C., Fort Myer, Va., and return to College Park. He piloted the early type Wright biplane, powered with a 40 horsepower engine revolving two propellers in tandem by the chain and sprocket method.

General Pratt Commands 2nd Wing

BRIGADIER-GENERAL Henry C. Pratt, Air Corps, commander of the Second (East Coast) Wing, recently departed for Langley Field, Va., to take over his new duties. He had been for some time on temporary duty in the Office of the Chief of the Air Corps conferring on various Air Corps matters.

General Pratt holds the flying ratings of Airplane Pilot and Airplane Observer.

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PRIVATE FLYING AND CLUB NEWS

Flying Clubs Maintain Activity

ROBERT B. HALL was chosen president of the Chesapeake Flying Club, Baltimore, Md., at the annual meeting. Other officers chosen were Otto Benda, vice-president; Clarence Fisher, secretary; Donald D. Lewis, treasurer; and Gail F. King, flight manager.

The organization is now entering its seventh year.

The Aeronautical Activities Association of Michigan, formed to stimulate greater state-wide interest in aviation in Michigan, has announced an Aviation Frolic and Stag Party to be held Friday evening, April 12, in the Cosmopolitan of Detroit, according to Thomas B. Colby, secretary. Groups of officers and fliers are expected from Selfridge Field, from the Border Cities Flying Club, from various cities in Michigan and from airports and flying clubs in Toledo, Cleveland, Akron and Buffalo.

The business meeting of the Aero Club of Parks Air College was featured by an interesting program presented by the Shell Petroleum Company. Dr. C. W. Rippie talked of the processes and methods by which Shell oils and gasolines are extracted and refined. The talk was illustrated with moving pictures.

New Clubs Formed

THE PILOTS' Club, Inc., South Bend, Ind., has received a charter and has decided to build a club house. The annual reorganization meeting and election of officers was recently held.

A flying club has been organized at Milan, Tenn., under the leadership of C. W. Coley. A flying school will be started and Southern Air Service, Inc., of Memphis will provide the instruction.

Corporation papers have been issued to the Darius-Girenas Aero Club, formed to promote aviation among Lithuanians in this country. At present there are sixteen members and the Club has purchased a training plane for instruction under the supervision of A. Kiela at Flushing Airport, Long Island.

The High Hat Flying Club, Inc., will also use the Flushing Airport. The club now has a membership of sixteen, and its members recently purchased a Travel Air and in addition it is planned to purchase a light plane in which primary instruction and training may be given.

Wisconsin Vets Stage Tour

THE SECOND annual good will air tour of the Wisconsin Veterans of Foreign Wars will be held from June 16 to June 22, according to Cliston Gosch, state aviation chairman. The tour will include five airplanes and 15 men and will visit 42 state cities in a trip of 3200 miles. Last year's tour visited 20 cities.

The tour, according to Gosch, is to arouse the interest of members of the Veterans of Foreign Wars in their next state encampment in Marshfield July 1 and to increase the interest of the general public in aviation.

Air Race Postponed Until 1936

THE PROPOSED international air race around South America has been postponed until the spring of 1936, according to Rex Martin, assistant director of the Bureau of Air Commerce.

The race was to take place this spring, but Martin said it was found insufficient time remained to make arrangements and permit entrance of foreign flyers.

THE INDUSTRY IN GENERAL

Personnel Changes

FILLING THE place held by the late Richard F. Hoyt, in the Curtiss Wright Corp., Thomas A. Morgan was elected chairman of the board at a recent meeting at which Guy W. Vaughan was elevated to the presidency of the corporation, the position formerly held by Mr. Morgan. Mr. Vaughan will remain president of the Wright Aeronautical Corp., of Paterson, New Jersey.

T. J. Campbell for the last four years vice-president and general manager of Berry Brothers, Detroit, has been elected president of the company. He retains his title as general manager. The Bureau of Air Commerce also announced two appointments during the past few weeks including Amelia Earhart as an aeronautical expert, and Richard S. Boutelle to advise state aviation officials in problems of aviation legislation, regulation and promotion in addition to attending to the activities of miscellaneous commercial and private aircraft operators. Chester Snow who has been actively engaged in blind flying experiments for the Department resigned.

The Aeronautical Chamber of Commerce also received a resignation, this one from O. M. Gardner, Washington, D. C. attorney who has been counsel for the Aero Chamber for the past year.

Fairchild Aerial Camera Corp., Woodside, N. Y., has employed Clarence L. Terrill in the patent department and Revere G. Sanders as sales engineer. H. T. Haslam has been appointed general sales manager of the domestic marketing affiliates of the Standard Oil Company of New Jersey and Ernest W. Dichman, consulting engineer of the Chance Vought Corp., is on an extended trip to the Far East in the capacity of Assistant to the president of United Aircraft Exports Corporation which maintains offices in Hartford, Connecticut.

Distributors Appointed

U. S. AERO Units, Inc., New York, N. Y. has been chosen dealer for the Rearwin airplanes.

In the past few weeks Beech Aircraft Co., has added nine new distributors including two in foreign countries. They are Beech-Air Sales Co., New York, N. Y.; Inter City Airlines, East Boston, Mass.; Gilpin Airlines, Tucson, Ariz.; Harry A. Hammill, Austin, Tex.; Raymond Aircraft Sales Co., Lakeland, Fla.; Beechcraft Sales, Burbank, Calif., Beechcraft Airplanes, San Bruno, Calif.; Maurice Salle, Paris, France; and Rogers-Jenkins & Co., Ltd., Johannesburg.

Val Dietz, Jr., Sales Manager of the Flightex Department of Suncook Mills announced the appointment, as exclusive dealers of Nicholas Beazley in Brooklyn, N. Y., and Glendale, Calif.; Pacific Airmotive Corp., Oakland, Calif., and Bredouw-Hilliard, Kansas City, Mo.

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Manufacturers Elect Officers

THE MANUFACTURERS Aircraft Association, Inc. at its annual meeting in New York elected the following board of directors: Charles F. Barndt, Great Lakes Aircraft Corp.; Clayton J. Brukner, Waco Aircraft Co.; Sherman M. Fairchild, Fairchild Aviation Corp.; R. H. Fleet, Consolidated Aircraft Corp.; J. H. Kindelberger, North American Aviation, Inc.; W. A. Mara, Stinson Aircraft Corp.; Glenn L. Martin, Glenn L. Martin Co.; James P. Murray, Boeing Aircraft Co.; John M. Rogers, Douglas Aircraft Co., Inc.; Frank H. Russell, Edward G. Budd Mfg. Co.; William E. Valk, Jr., Curtiss Aeroplane & Motor Co., Inc. and E. E. Wilson, Chance Vought Corp.

Frank H. Russell was re-elected president, while other officers elected include vice-presidents: Glenn L. Martin, E. E. Wilson and Sherman M. Fairchild; secretary: John M. Rogers; treasurer: C. J. Brukner and general manager: S. S. Bradley.

Kinner Enlarges Showroom Space

KINNER AIRPLANE and Motor Co., is moving into the hangar occupied by Charles Babb at Grand Central Air Terminal, Glendale, Calif. This space will be occupied in addition to the hangar the company has been using for more than a year as a showroom.

S-T Offers Wider Cruising Range

RYAN AERONAUTICAL Co. is planning to offer an extra front cockpit 24-gallon fuel tank as optional installation on its new Ryan S-T low-wing ship. This installation, which will give the plane a total cruising range of approximately 800 miles, will include a metal cockpit cover.

The extra fuel tank will be easily removable so that the plane can be used as the conventional two-place job.

December Exports Top $1,450,000

AMERICAN AERONAUTICAL exports went to purchasers in 49 countries during December, 1934 when the total value of the exported products brought $1,454,679. Nineteen aircraft, valued at $451,073 and 68 engines, worth $541,298 made up the bulk of the sales, while parachutes brought $28,253 and parts and accessories brought $430,713.

Russian purchasers took $506,588 worth of American products during the month, far outstripping the second best customer, China, and her $320,892 purchases. Argentina also ranked high, spending $176,299 for 22 engines, 1 airplane and parts and accessories; Turkey made a $28,253 purchase of chutes.

Seven aircraft were sold in China; Mexico and Africa took 2 each; and 1 each went to Czechoslovakia, Norway, Portugal, Switzerland, Guatemala, Panama, Argentina and Uruguay.

January exports reached $1,556,509 following the sale of 28 aircraft and 32 engines, various parts and parachutes. China accounteed for 15 planes costing $606,225 and 10 engines costing $41,235, as well as $48,333 for parts and accessories.

Aside from China, aircraft were purchased in Switzerland, Mexico, Argentina, Hawaii (2 each), and in the Netherlands, Costa Rica, Cuba, Brazil and Peru.

1615 Aircraft Produced in 1934

PRODUCING 1615 aircraft in 1934, American manufacturers of aircraft exceeded production totals of 1932 and 1933, and halted a downward trend which had continued since 1930.

According to the Bureau of Air Commerce, in the last six years the annual totals of aircraft produced have been: 6,193 in 1929; 3,437 in 1930; 2,800 in 1931; 1,396 in 1932; 1,324 in 1933; and 1,615 in 1934. The increase is particularly noteworthy in small civilian planes of the types suitable for private owners.

Of the total production in 1934, 853 aircraft were for domestic civil use, 393 were for delivery to military establishments, and 369 were exported.

The industry produced 661 monoplanes, including 255 open cockpit type and 406 cabin craft, and 1,932 biplanes, 66 of which were open cockpit and 126 cabin craft.

With respect to the aircraft manufactured for civil use, 5 companies manufactured 60 or more, accounting for approximately 50 per cent of the aircraft manufactured for this purpose.

Arup Moves to South Bend

FACTORY OPERATIONS of the Arup Manufacturing Co., manufacturers of the all-wing Arup plane, have been returned to South Bend, Ind., from Indianapolis.

At a recent election of officers, H. L. Stewart was elected president. Dr. C. L. Snyder, designer of the plane, continues as vice-president while other officials are Dr. F. J. Vurpillat, secretary, and R. M. Goheen, treasurer.

Digest of Recent Events

Andrews Sets Los Angeles to Mexico City Record

LELAND S. Andrews flew a Vultee transport with five passengers from Los Angeles to Mexico City in 8 hours 9 minutes, exceeding by 2 hours 6 minutes the previous best mark for the 1,670-mile flight. The ship was identical to the one Andrews flew recently in setting a new Los Angeles-New York speed record.

MAR. 6

Martin Flying Boat Carries 51,000 Pound Load

FLYING A gross weight of 51,000 pounds, which constituted a new record for flying boats, the Martin Clipper Ship Number 7 completed an hour and a half flight over Chesapeake Bay during a series of test flights being made before application for an ATC. The ship was manned by a crew of six and loaded with 4,000 gallons of fuel and lead ballast.

MAR. 12

Post Makes Second Stratosphere Hop

FLYING AT approximately 340 miles an hour between Burbank, Calif., and Cleveland, Ohio, where he landed the *Winnie Mae* due to his diminishing oxygen supply, Wiley Post set a new record between the two points, although he failed in his attempt to span the coasts in eight hours or less. The flight to Cleveland took 8 hours 4 minutes, including an additional 100-mile flight beyond Cleveland before returning to the Municipal Airport there.

MAR. 15

Sikorsky Sets Three Seaplane Records

CREDITED BY officials with establishing three new records, including the world's seaplane distance mark, the Pan American S-42 Sikorsky completed a 2,504 mile round-trip flight between Miami and the Virgin Islands, exceeding by 105 miles the former mark held by Lt. Comdr. Nefler McGinnis. The plane also established an American closed course record for seaplanes and a distance record during its 17 hour 16 minute flight, which was made entirely over water.

MAR. 23

Transport Flies U. S. in 12 Hours 44 Minutes

A TWA Douglas transport made one of the fastest transcontinental flights when it arrived at Newark from Los Angeles in 12 hours 44 minutes, 39 minutes of which was spent on the ground at regular stops en route. The plane was flown by Pilots Wayne Williams and R. W. Heideman, who averaged 228 miles an hour.

MAR. 16

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Aircraft and Engine Sales

DELIVERY OF a new Stinson Reliant to the Richfield Oil Company of California was announced by Aircraft Industries, Stinson distributors at Grand Central Air Terminal, Glendale, Calif. The Standard Oil Company of New Jersey purchased a new Douglas Dolphin and the Aircraft Development Corporation reported the sale of four Vultee V1-A transports to American Airlines and Bowen Airlines each of which took two.

Evidencing the growing popularity of the Douglas airliner, orders for two DC-2 transports were received from the Polish Air Line "Lot."

St. Louis Flying Service of Lambert Field sold a Fairchild "24" to Dr. L. M. Hunter of Little Rock, Ark., and a Monocoupe to P. W. Black of Auvergne, Ark. A Bellanca Skyrocket was sold to Newton H. Cromley of Elko, Nev., for use in charter trips for various mining companies. Aircraft Sales of Roosevelt Field made the sale through Jack McKenna. Waco Sales of New York, also of Roosevelt Field, reported the purchase of a Waco F-2, Jacobs-powered, by G. Wallen and Jack Warner of Armonk, N. Y.

Menasco Manufacturing Co., Los Angeles, reports engine deliveries for January better than any previous month in the history of the company, exceeding January, 1934, by more than 100 per cent.

Curtiss Aeroplane and Motor Corp. received an order for 135 scout and observation planes from the Navy Department.

Taylor Cub Agent Appointed

INDIANA FLYING Service, with headquarters at the Bendix Municipal field, South Bend, Ind., has been named distributor for the Taylor Cub, by the Taylor Aircraft Co., Bradford, Pa. Rudolph Van Devere, manager of the Indiana Flying Service, is co-manager of the airport at South Bend, under an appointment recently made by the city aviation commission.

Financing Company Formed

AVIATION FUNDING Corp., with offices at 270 Madison Ave., New York, N. Y., has been organized to provide airplane deferred payment financing. Gordon M. Curtis is president; W. W. Brinckerhoff, secretary-treasurer; and Franklin Field and John Scannell, directors.

The company is offering its service to manufacturers of aircraft for civil use and a new method of insurance has enabled it to offer a finance rate comparing favorably with automobile practice.

New Paint to be Marketed

NATIONAL COPPER Paint Co., Chicago, Ill., has been formed to manufacture and market a new liquid paint. Officers are H. M. Rice, president; C. L. Welch, executive vice-president and Frederick A. McLauchlan, secretary-treasurer.

The items constituting the company's present line are a liquid copper paint, a liquid copper primer, and a liquid copper reducer to thin out the paint for spraying purposes.

COMING EVENTS

Final examinations for Air Corps appointments will be held by the War Department. April 2

•

The First National Intercollegiate Flying Conference is to be held in Washington, D. C., under the auspices of the N.A.A. April 2-3

•

Dedication of Jersey City, N. J. Airport, under direction of Eddie Schneider, April 27

•

The Intercollegiate Flying Club Air Meet will be held at the Municipal Airport, Northampton, Mass. May 4

•

The Second Annual Good-Will Tour of the Wisconsin Veterans of Foreign Wars will visit 42 cities, June 16-22

•

The Thirty-eighth Annual Meeting of the American Society for Testing Materials will be held at the Book-Cadillac Hotel, Detroit, Mich. June 24-28

•

The Sixth Annual National Soaring Contest will be held at Elmira, N. Y. June 29-July 14

Financial Reports

A NET profit of $2,161,136.39 was reported in the annual report of the Bendix Aviation Corporation. This profit exceeds the net profit of 1933 by $785,994.11, not including items of foreign subsidiaries. After deducting all charges including depreciation, development expenses, taxes, etc., the consolidated net income for 1934 amounted to $1,903,120.40, not including the corporation proportion of the 1934 net income of the non-consolidated subsidiaries and affiliated companies.

Curtiss-Wright Corporation showed for the year 1934 a net operating profit of $359,736.69 compared to a net profit of $135,896.27, in 1933. Sales amounted to $14,009,533.03 in the year showing a gain of 34 per cent over 1933 and unfilled orders on hand as of March 19, 1935, totaled $7,791,512.77.

United Aircraft Corp., and subsidiary companies reported a net loss for the 4 month period, September 1 to December 1, 1934, of $27,026.72. Unfilled orders on the books of December 31, 1934, amounted to $7,533,661.86.

In their first report to stockholders since their formation as an independent manufacturing organization last fall, Boeing Airplane Company and its subsidiaries, Boeing Aircraft Co., of Seattle, and the Stearman Aircraft Co., of Wichita, reported losses for the last four months of 1934 amounting to $225,977.15. Expressing confidence in the outlook for future business, C. L. Egtvedt, president advised stockholders that both companies have been working on new commercial and military designs which, it is hoped, will result in future sales.

The Sperry Corporation for the year ended December 31, 1934 reported a net income of $1,878,104.32, which included a net profit of $347,669.99 on the sale of securities.

Martin Boat Resumes Tests

CONFINED TO a hangar for almost three months because of ice conditions in Middle River and Chesapeake Bay, the Clipper Ship constructed by the Glenn L. Martin Co., for Pan American Airways again took to the air early last month, resuming tests which will last until June. The first test was a check of righting moments to determine stability on water.

Since the last trials the sea wings, which carry 1,000 gallons of fuel each, have been reinforced.

FOREIGN NEWS IN BRIEF

Australasia

IN ADDITION to the 18 new Demon planes arriving from England for the Royal Australian Air Force, an additional 36 will be ordered almost immediately. A similar number will be ordered for next year, but a change will be made in the type of craft. A new base is to be established in Fremantle, and an extra squadron is to be located at Richmond.

ESSENDON AERODROME is to be enlarged by 100 acres, and there will be a NS-EW runway of not less than 3000 feet, and a NW-SE runway of at least 3750 feet. These extensions will allow the D.H. 86 airliners to land there instead of at Laverton.

THE CIVIL Aviation Department is considering bids for service between Bourke and Adelaide, to form a link with the Imperial air route. It is expected the service will be in operation about July of this year.

THE GOVERNMENT has allocated about $175,000 to be spent on improvements of airports and airways on the Australian section of the England-Australia air service. The principal ports on which the money will be spent are Darwin, Mascot, Cootamundra, Essendon, Camooweal, Cloncurry, Longreach, Charleville, Roma, and Archerfield.

H. C. ARMSTRONG, representative of the British Pacific Trust, of London, is now in Australia investigating the development of commercial aviation. Following investigations, he will be authorized to spend £100,000 in extending commercial air services. According to Mr. Armstrong, the Trust is primarily interested in the development and manufacture of aircraft and the operation and extension of services in Australia.

A HOLYMAN airliner recently established a record flight from Launceston, Tasmania, to Melbourne, Victoria, via King Island, covering 394 miles in 2 hours 30 minutes, including King Island to Laverton in 55 minutes, an average of 180 m.p.h.

Canada

A NEW high was established for air mail poundage carried on Canadian planes during 1934, according to the Department of National Defense, when 625,040 pounds were carried, almost 113,000 more than the previous year.

Canadian air mail poundage is made up largely of mail carried at ordinary letter or parcel rates. Not quite 70,000 pounds of the total were carried at air mail rates, and only on three routes, two of which connect with U. S. routes at Albany and Pembina. The balance goes to outlying districts or regions isolated by seasonal weather or to catch trans-Atlantic steamers.

A SIX per cent increase in the 1934 flying time activities of the 22 Canadian clubs was reported at the annual meeting of the Canadian Flying Clubs' Association at Ottawa early last month. A total of 10,581 hours were reported as against 9971 the previous year; 134 members received private licenses and 21 qualified for commercial pilot licenses. Since the clubs originated, 945 private and 270 commercial pilot certificates have been won by the club members. Officers elected were R. J. R. Nelson, president; Major-General J. H. MacBrien, honorary president; Lloyd H. Smith, first vice-president; B. Marcuse, treasurer; vice-president for Maritime Provinces, F. J. Mosher; vice-president for the central zone, W. A. Curtiss; vice-president for western zone, Dr. E. A. McCusker; vice-president for Pacific zone, Wm. MacKenzie. The advisory board consists of H. P. Crabb, chairman; A. H. K. Russell, H. H. Richards, and J. A. Sully.

CANADA IS rushing to completion her transcontinental airway so that by the summer of 1936 European mail will be less than 3½ days from Montreal and less than 5 days from Vancouver. With the trans-Canada airway in operation and fast planes flying the route, Canada will receive much of the European mail for the Asiatic continent. Atlantic steamers will be met by planes (as they are now in summer), as they enter the Strait of Belle Isle, mail transhipped to airplanes, and delivered 18 hours later in Vancouver to connect with fast trans-Pacific steamers.

To make this possible, a chain of emergency landing fields is being built across isolated sections of Canada's northland, as part of the Dominion's unemployment relief program. In all 114 fields are being built, approximately 25 miles apart, the majority of which are now finished or nearing completion.

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"Shell" photo

Two Cierva C-30 autogiros being refueled in Paris while en route to Spain

Czechoslovakia

CZECHOSLOVAKIA'S CIVIL aviation budget for 1935 is $1,476,000, an increase of 27 per cent over 1934. Of this amount, $1,198,000 will be expended directly for aviation purposes, the balance being for administrative functions.

France

THE FRENCH Air Ministry has offered a speed prize of $600,000 for any plane, equipped with an engine of French construction and operating on fuel oil, which surpasses the existing speed and endurance record of 93.2 m.p.h. for 6214 miles in closed circuit. The time limit set is December 31, 1936 and in the event the winning engine carries a foreign registration, even though it is of French construction, the prize will be reduced to $330,000.

FRENCH AIR mail service has grown rapidly, so that now 45 mail planes either leave or arrive at Le Bourget airport daily. In addition the Paris-Lyons-Marseilles has been extended to Rome. Other services remain as before, operating between Lyons and Cannes, and between Paris and Strasbourg, thus providing air mail service to 53 cities on the continent, including all the capitals.

THE LATECOERE flying boat *Lieut. de Visseau Paris,* now undergoing flight tests in France, has accommodations for 64 first-class passengers, and in its two-deck fuselage are 12 de luxe cabins. The seaplane is built of duralumin and stainless steel, weighs 32 tons, measures 105 ft. in length, has a wing spread of 164 feet and is driven by six 850 h.p. Hispano Suiza engines. It will carry 6340 gallons of fuel in pontoons attached to lower wings and will have a cruising range of 2796 miles when used in transoceanic services.

Germany

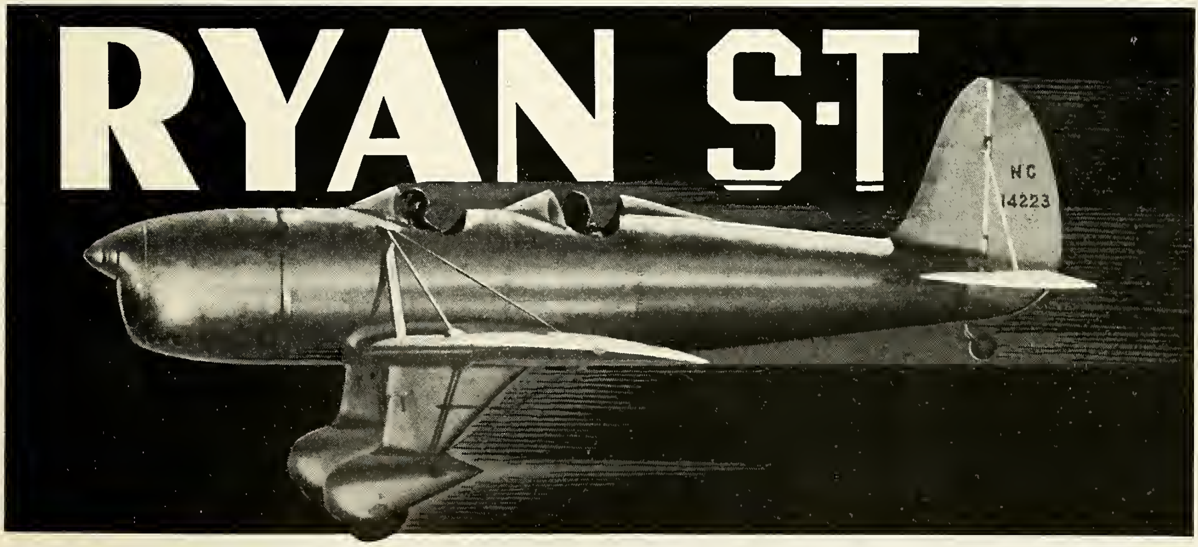
AIRSHIP SERVICE between Germany and the United States is expected to get under way July 15, 1935 with the new L.Z.129 making a round-trip every ten or fourteen days. Tentative plans call for a schedule of 48 hours between this country and Germany, and 55 hours for the westbound flight. The carrying capacity of the dirigible will be 50 passengers and 20 metric tons of mail and express. One-way fare will be approximately $300.

Great Britain

THE AIR Ministry has ordered a number of Hawker *Hardy* general purpose biplanes, new ships developed from the *Hart* day bomber which has been in R. A. F. service for a number of years. The *Hardy* is specially prepared for service in the Middle East and may be equipped with extra fuel tanks to increase its range and with a drinking water tank for use on desert patrol. Radio gear and photographic apparatus are also included in its equipment.

Powered by a Rolls Royce *Kestrel* engine of 525 horsepower, the *Hardy* can carry two men, two machine guns and, when necessary, bombs in racks beneath the wings. The order for the new type plane brings the total number of types supplied by the Hawker company to nine, an unprecedented number of types for any one manufacturer to supply to the R.A.F.

IN BRITAIN, where autogiro development has proceeded rapidly, the present high spot of "windmill" plane interest is the new four- or five-place autogiro, which will soon be making trial flights. Built by the Westland aircraft works, the machine is expected to show a maximum level speed of about 160 m.p.h., and capacity to transport a considerable load in fuel, crew and equipment. Although originally designed as a civil aircraft with



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its early trials directed to test its capacities in ordinary commercial use, subsequent tests will be undertaken to determine how near it approaches military requirements.

1935 AIR estimates show the first effects of the government's decision to expand the R.A.F. to a numerical strength more nearly commensurate with that of the Air Forces of other powers. Approximately $119,255,000 has been set aside for the project which will add 11 new squadrons to the Home Defense force this year, bringing its strength up to 54 squadrons, of which 41 will be regular squadrons and the remainder Air Force Special Reserve squadrons. The Fleet Air Army is to be increased by 19 first-line aircraft. In all the additions will raise the total strength of the R.A.F., including the Fleet air craft, to 93½ regular squadrons and the 13 non-regular squadrons of the Home Defence Force.

AIR SERVICE between England and the Channel Islands has surpassed expectations. By train and ship the quickest time is usually more than 12 hours. The *Dragons,* cruising at 114 m.p.h. take two hours for the journey, and the new D.H. 86's, which cruise at 145 m.p.h. will make a further reduction in the time. Last year, Jersey Airways, operator of the route, flew 632,115 miles and carried 19,844 passengers.

Mexico

TWO AIRLINES have been started in eastern Mexico. One is operated tri-weekly for passengers and mail by the Tampico Aero Club from Tampico to Huejutla, Hidalgo, with stops at intermediate points. Stinson planes, piloted by Mexican pilots, are used. The other is a semi-weekly passenger-mail service between Puerto Mexico, Alvarado and Papaloapan, Vera Cruz.

SIMPLIFICATION OF immigration regulations as a means of increasing air travel, and less rigid customs regulations for air express, along lines similar to legislation put into effect by Guatemala and Costa Rica, together with a modification of the absentees' tax law were among the principal resolutions adopted at the Inter-Americas air communications convention held in Mexico City recently.

PERSONAIRLITIES

(*Continued from page* 134)

the nobility of labor and what a privilege it was to be born with a sound mind and body so I could work hard and be noble. I realize now that the old lady had got hold of some of J. P. Morgan's propaganda releases and was feeding it to me by mistake. Anyone is welcome to all the nobility of labor there is—I'll take a yacht.

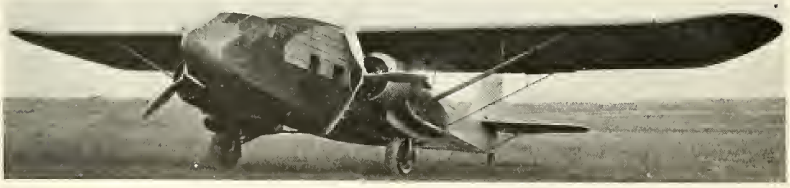
Old Cape sat him down on the *Alva* last February off the Chilean Coast, with an attentive steward fanning him and handing him cooling drinks, while he wrote me a letter. Just to give you an idea of the tough time he's having, I publish it herewith:

"We've been out of Miami about a month now on this cruise, and it's the cat's. We stopped at Havana, Kingston and Cartagena. Last named was first time we used the airplane as Mr. Vanderbilt was anxious to get south as quickly as possible. At Cartagena, we flew over to Barranquilla and up the Magdalena River about 250 miles. Intended to go to Bogota, but weather cancelled us out at a place called El Banco.

" . . . Then at Panama, Colon, I flew over to Albrook field on the Pacific side, as the canal people wouldn't permit the yacht to go through with the plane on board. We then flew several trips in vicinity of the Zone, including the San Blas Indian islands. The yacht proceeded to the Pearl Islands, south of Panama, for some fishing; and a couple of days later I flew down there and was hoisted aboard for the trip down the west coast of South America. A member of the crew contracted some sort of disease, and next morning I flew him back to Panama and then returned once more to the yacht and we proceeded down the coast.

"We are due in Valparaiso, Chile, first thing tomorrow (Feb. 2d). Plan to fly the ship (no passengers) from Santiago to Buenos Aires in a couple of days. Mr. Vanderbilt does not like the idea of negotiating the Straits of Magellan with the plane on board. Blows like hell down there, they say. So I shall have about three weeks holiday in B. A., waiting for the yacht to come around and up the coast. Due in Miami about April 15th, and then New York. Hot Dog!"

To which I beg leave to add "—and don't spare the mustard!"



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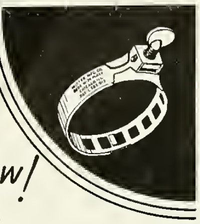

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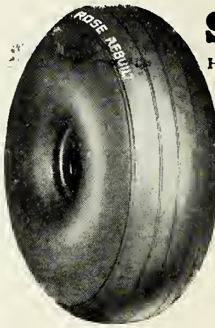

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FOR SALE: Lockheed Altair, Wasp 450 h.p., in excellent condition, with 196 gallon gas capacity, cruising range 7½ hours. Price $8,800. Details given on request. C. E. Shankle, Tubac, Arizona.

BARLING NB-3: Excellent condition, $720. Come to Sunny Florida and fly it back home. Write at once for particulars. Gordon Harrington, 1025 11 St. North, St. Petersburg, Florida.

AUTOGIRO: Central Pennsylvania newspaper has completed a successful campaign using a Pitcairn Autogiro. Campaign is over and 'giro can be purchased very reasonably. Specifications: Pitcairn PA-18 Autogiro. 165 h.p. Kinner. Ship and engine in excellent condition; 150 hours. A real bargain. Write AERO DIGEST, Box 2016.

BUHL SPEEDWING PUP: Perfect condition Just relicensed. Special equipment. Blue and silver finish. $400 cash. Will trade in on Moth, Avro or Arrow. Fred. Howard, Oswego, Ill.

SACRIFICE DH MOTH: 385 hours, condition excellent. Always privately owned. Pioneer bank and turn, rate of climb, Irvin parachute. First $600 takes all. Wire or write: Virgil Spurling, Columbia, Missouri.

PITCAIRN AUTOGIRO: Kinner, 131 hours. Starter. Licensed to June 15, 1935. Price, $1,800. John M. Miller, Rt. No. 1, Hatboro, Pa.

TRAVEL AIR 6000; Travel Air 4000; Wasp 6-place cabin Laird; Laird LCB Speedwing and large stock airplane and motor parts. Must sell. State offer first letter. Trades considered. Watch our ad next issue; of personal interest to all concerned with aviation development. Heart of the Lakes Airways, Wisconsin Dells, Wisc.

CURTISS-WRIGHT Air Sedan: 210 h.p. Kinner motor; licensed; excellent shape, $1,800. Rearwin Junior: 45 Szekely motor; licensed, excellent shape, $800. Single-place Aeronca: Licensed; excellent shape, $400. East Dayton Airport, Dayton, Ohio.

1933 STINSON DeLuxe Executive model: Cost $8,600; price $4,395, cash only. Complete night and blind flying equipment. Beautiful job, perfect condition. Fred Block, Peoria, Illinois.

TRAVEL AIR: Detachable OX motor mount, reconditioned, complete motor cowlings, radiator, wheels. Herbert Westphal, 1817 E. Jarvis St., Milwaukee, Wisconsin.

TRADE IN your licensed airplane on a new Fairchild "24": Send us complete description of your ship and we will quote you estimated trade-in value. Aviation Supply Division, Montgomery School of Aeronautics, Montgomery, Alabama. (Southern Fairchild Distributors.)

FOR SALE: Curtiss Junior, very good shape, 250 hours, with new license. Will sacrifice for $360. Write or wire George Distel, Le Sueur, Minnesota.

FOR SALE: OX-5 Curtiss Robin, licensed to December 1935. Ship and motor in perfect condition. Ship approximately 250 hours, motor 75. Regulation instruments, compass and air speed. Price right. Home-built sportplane: as is, $25. Two 5-ft. sport plane propellers. AERO DIGEST, Box 2014.

LOCKHEEDS: ORIONS, latest type. Controllable pitch propellers; S-1-D-1 engines; wing flaps; two-way radio. Sirius: Two-place; C-1 Wasp. Air Express: C-1 Wasp. Vega: six-place; C-1 Wasp. Vega: Wasp Jr. Vega: Wright J-5. Prices and full description on request. Babb, 1100 Airway, Glendale, California.

FLAMINGO G2W: Excellent condition, very few hours time; complete night, blind flying equipment; will consider Stinson on trade. Stinson 1933 Reliant: Complete with radio, night, blind flying equipment. Ship, engine, excellent condition. Monocoach, powered with Wright J6-7. No time on plane since complete overhaul. Bargain in 4-place cabin plane. Curtiss-Wright Jr., priced very low. Plane and engine have 30 hours since major overhaul. Waco "C," excellent condition. Waco "F" Warner, plane, engine newly overhauled. Vermilya-Huffman Flying Service, Lunken Airport, Cincinnati, Ohio.

"PIONEER" offers Taylor Cub: Continental A-40 with relicense before delivery. One hour since overhaul. $750 cash or terms, flyaway, Pennsylvania. First deposit received, preference. Pioneer Aviation, Airport, Syracuse, New York.

WE'LL TAKE YOUR SHIP in trade on new de luxe Lambert Monocoupe. Give complete details concerning your airplane in first letter and we will send estimate of its trade-in value. Central Monocoupe Distributors, Lambert Field, St. Louis, Missouri.

GIPSY MOTH: Major overhauled and licensed to April 1936. Sacrifice, $650. Joseph Fling, Boulevard Airport, Philadelphia, Pennsylvania.

MONOCOUPE: Latest type Warner 125; built-in rocker-box covers, etc. Special finish, black fuselage, cream wings, crimson trim and lettering; racing landing gear, pants, special streamlining, including strut end fairings, extra instruments. Never damaged, always hangared and cannot be distinguished from brand new. Total time 220 hours. $2,700. R. D. Morgan, Bellanca Airport, New Castle, Delaware.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

PLANES AND ENGINES FOR SALE

VELIE M-65 MOTOR: 513 hours; 16 hours since top; installed new Thompson silchrome valves all around; $145 f.o.b. Prop for same, $15. Altimeter, tachometer, Pioneer compass, $3.50 each, or all $10. Monoprep tail surfaces, good, $20. Joseph J. Masek, Box 147, Eagle Lake, Texas.

TRAVEL AIR SPORT: B-5 Kinner; $1,650. Many extras, excellent condition. Lambert Monocoupe: $1,700, good condition. Trades considered. Dick Schall, Berwyn, Maryland. Telephone: Greenwood 1676.

WE BUY AND SELL used airplanes and equipment. Cash paid. Quick action. All dealings confidential. Get in touch with us. Pioneer Aircraft, Airport, Syracuse, New York.

BUHL: Wright 300, modernized. 6-place; cruises at 120. Completely recovered last August. Beautiful red and blue hand-rubbed finish. Licensed to March, 1936. 124 gallon gas capacity. Has turn and bank, landing lights, radio. Price $1,750. Will accept your ship or car as part payment. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

J-5 BELLANCA: Perfect condition; late motor; 6-plane; 292 pounds baggage; 85 gallons gas; new tires, brakes; tailwheel; photographic aperture; $2,200. M. Coffrin, 1325 67th Street, Brooklyn, New York.

CHALLENGER ROBIN: Special paint job. Faired fuselage. Beautiful ship. Complete flying instruments. Licensed till August 1935. In Metropolitan area. Will consider smaller ship in trade. AERO DIGEST, Box 2029.

CONTINENTAL WACO: Full equipment, including radio; perfect condition, $3,000. Continental Waco: R C A radio, $3,900. Four-place Buhl, Wright J6-9, complete; 60 hours since overhaul, $1,500. Trimotored Wasp Ford: $8,000. 6-place Bellanca; motor needs overhaul. Beech Aircraft Co., Wichita, Kansas.

AERONCA C-3, '34 model; always hangared, privately owned, like new. Price and details on request. Ben Sweazey, Crooksville, Ohio.

C3B STEARMAN: J-5; no time since major; speed ring, steel prop, bank and turn, rate of climb, electric starter, generator, landing lights, oleo landing gear, low pressure tires, brakes. AERO DIGEST, Box 2023.

FOR SALE AT BARGAIN: J-6 330 h.p. B-5 6-place Ryan cabin ship. Equipped with Goodyear full Airwheels and brakes. Excellent set of instruments. Licensed till September, 1935. Will accept lighter ship as part payment. Michigan Aero Motors, Jackson, Michigan.

FOR SALE: Whittelsey Avian. Cirrus Mark III; licensed, slots, full airwheels. Ideal training ship. $500 cash or will trade. L. G. Lightfoot, R. R. 1, Gary, Indiana.

B-5 KINNER Model 7, de luxe Fleet: Fully equipped. 600 hours. Excellent condition. $1,450. No trades. G. D. Sweisherger, 1222 Blain Avenue, South Bend, Indiana.

STINSON S: Black and silver. Perfect condition; 425 hours. Equipment: Turn and bank, rate of climb, flares, fenders and many others, $1,900. Challenger OX-5: Perfect condition, $450. Wanted: Waco F-2, Continental 165 h.p. or Great Lakes, inverted Cirrus. Sidney Press, Hummelstown, Pennsylvania.

WACO F, WARNER: Covering and finish like new. About 40 hours on motor since major; steel propeller, Heywood starter, bank and turn, pitch indicator. Ship and motor absolutely A-1 condition. License expires 1936. Exceptional value, $1,400. No brokers. Pilot, Box 273, Oakdale, Louisiana.

FOR SALE: Curtiss-Wright Sedan; good condition. Challenger engine, 185 h.p. Licensed until July 1935. Price, $1,100. L. L. Hamilton, National Pressure Cooker Co., Eau Claire, Wis.

WASP-POWERED IRELAND Amphibion: Good condition; just relicensed. A real bargain. Troy Flying Service, Troy, Ohio.

VIKING FLYING BOAT: Four-place, licensed, fine performance, $1,400. Consider late car as part payment. M. C. Bradley, Somers Point, New Jersey.

LATEST TYPE de luxe two-place Fleet; B-5 motor with exhaust collector ring. Many extras. Total time, 170 hours. Also three-place Fleet with Kinner B-5 motor. Many extras. Both ships excellent condition. Bargain prices. Leslie H. Bowman, Union Air Terminal, Burbank, California.

WACO A, JACOBS 170: Just repainted deep vermilion, silver wings; fabric excellent; duals, navigation lights, wired for landing lights, flares, extra luggage compartment, cockpit heaters, winter enclosure, 2 Irving silk parachutes, motor factory overhauled like new, starter, prepared for radio, price $1,900. Dr. Chas. Lieher, Waukegan, Illinois.

MONOPREP: Velie M-5. Licensed to July 15th. Excellent condition; duals, compass, air-wheels; $575 cash. Myers Aviation Co., Brackenridge, Pennsylvania.

AERONCA C-3. Late model in excellent condition and priced right. Will take another ship as part payment. State condition and price in first letter. Terms. H. B. Kaywood, 169 Avondale, Jackson, Michigan.

TAYLOR CUBS: New or used. Liberal terms. Stinson SM8A Lycoming and Curtiss Fledgling, priced to sell. Write for details. Meinke-Eldred Flying Service, Willoughby, Ohio.

CRACKED AERONCA one-place: Both wings damaged, repairable. Motor good. Front end fuselage damaged, repairable. Bargain at $175. Wm. Picune, 743 34th Street, North Bergen, New Jersey.

BARGAINS: Wasp all-metal 8-place Flamingo, fully equipped for night and blind flying, starter, generator and radio. Recently major overhauled. Will accept trades on large or smaller fast jobs. Challenger Robin, $800. Kinner front-exhaust Fleet, $1,000. Indiana Air Service, Bendix Municipal Airport, South Bend, Indiana.

BARLING: 3-place NC414-V Velie M-5. 100 hours since overhaul. "Duolux," red and white. Airwheels and airspeed. $800. Accept car. Deliver anywhere. W. E. Gerher, Kewanee, Illinois.

TRADE IN your automobile or used plane on a reconditioned Fleet, Kinner K-5; Stearman J6-7; Cessna J-5; Wallace Touroplane, Continental; Curtiss Sedan, Challenger; Travel Air J-5; Challenger J6-5; Taylor Chummy, Kinner; Great Lakes; Taylor Cub; Monocoupe Lambert; Stinson SM8A; Waco, Kinner; payment plan. Write now. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

FOR SALE: Streamlined Warner Monocoupe. Licensed; motor overhauled; extras, $1,125. Accept plane or light car as part payment. Further information, write Clifton Wolfe, Market St., Bloomsburg, Pennsylvania.

TRAVEL AIR BIPLANE for sale: Wright J6-7, electric starter, generator, radio, flares, landing lights, special instruments. Ship and engine in excellent condition and a bargain. Tony Little, Patco Flying Field, Norristown, Pennsylvania.

BIRD: Kinner front exhaust, just majored; duals; airwheels; complete instruments; fabric and general condition perfect; licensed; N. Y. C.; exceptional value at $1,250. AERO DIGEST, Box 2038.

WACO F: Kinner B-5; 350 hours total. Hamilton steel prop, collector ring, navigation lights, duals, Heywood starter, semi-airwheels and tailwheel; black fuselage and red wings. Licensed to April, 1936. $1,400 cash or trade on Waco cabin. Biddlecombe Flying Service, St. Louis, Michigan.

TRAVEL AIR 6000: J6-9, latest model, just completely recovered, motor major overhauled. White and red. Flares, landing lights; upholstery perfect. Beautiful ship throughout. Picture for stamp. Best Travel Air buy in country. Western Airplane Distributors, 600 Graphic Arts Building, Kansas City, Missouri.

ROBIN: Challenger engine; recovered last year; maroon and silver; ship and engine perfect; shielded for radio; standard instruments; licensed; one price, $900. J. Warren, 316 Rutland Road, Brooklyn, New York.

"PIONEER" OFFERS BUHL J-6 300 h.p. cabin: 6-place, just recovered, snappy color, fully equipped. See this airplane. Reasonable offer or trade considered. Pioneer, Airport, Syracuse, New York.

WACO 3POLB: Wright J6-5 engine; A-1 covering, brakes, steel prop, anti-drag ring; just relicensed; $1,000. J. W. Lytle, 2333 Vodeli St., Pittsburgh, Pennsylvania.

WACO F: 125 Kinner. New October, 1932. 270 hours. Licensed until September, 1935. Wheel pants, speed ring, military windshield. Priced for quick sale. Consider Taylor Cub trade. A. G. Becker, Dravosburg, Pennsylvania.

DE LUXE LAMBERT MONOCOUPE: 5 months old. Has turn and bank, Kollsman altimeter, starter, battery, genuine leather upholstery, 90 hours total. Will accept your ship in trade. $2,850. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

FOR SALE OR EXCHANGE: 14 certified airplanes to choose from, as follows: J-6 Ryan B-5 Cabin ship, air wheels; J-6 6-place Stinson cabin ship, air wheels; 2 OX-5 Travel Airs; 2 OX-5 Waco 90's; 2 J-5 Straight Wing Wacos; Continental A-40 powered Heath; J-4 Waco; C-1 Ryan J6-7 4-place cabin ship; Rover 75 h.p. 2-place Driggs training ship, late model, many extras; J6-5 175 h.p. Straight Wing Waco; J-6 250 h.p. Straight Wing Waco. A-1 ships, NC-licensed and ready for delivery. Good late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

WARNER STINSON 125: Plane and engine excellent condition; luxurious upholstery; equipped for night flying. Complete set of instruments and lights; Bendix brakes, oleo tail. Only 380 hours, all transport. Latest ship of its make. Licensed till October. Price $850 for quick sale. Sahhah, General Electric, Schenectady, New York.

BARGAIN PLANES FOR SALE: J6-7 Waco Straightwing, in excellent condition. J6-5 Travel Air with high gloss finish. J6-7 Cessna, Miami Air Race winner. Airport, Natick, Massachusetts.

WANTED: 22 x 10-4 hubs, with brakes. Waco '32 cabin, 210 Continental; factory major, $2,250. Driggs Skylark: Inverted 75 h.p. Rover, excellent condition; ideal trainer, $900. Curtiss Fledgling: Completely rebuilt, never cracked; finest trainer available, $850. Warner Stinson: Good condition, duals, $885. OX Challenger: Miller overheads, Scintilla magneto, no time since major overhaul; recently recovered; $495. Lycoming engine, R-680, no time since major; heavy duty crankshaft. $475. Switlik chute, white silk, 24 ft. seat pack, $75. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, O.

CURTISS JR.: Licensed, in excellent condition; late Szekely, majored. $450 cash, or terms to responsible buyers. P. V. Sturges, Geneseo, New York.

HISSO EAGLEROCK: Just recovered, relicensed; hand rubbed finish. Nearly new special Hisso, Scintilla mags, Stromberg carb. Many extras. Cash deal preferred or 1934 V-8 coupe as part payment. Bruce Gatton, 28 S. Clinton, Iowa City, Iowa.

STINSON J-5: Oversize semi-air wheels and oleo shock struts; NC'd to October. $975 cash. Trade for Monocoupe. Ralph Kenyon, 345 Linwood Ave., Newtonville, Massachusetts.

185 H.P. CHALLENGER ROBIN: Licensed February, 1936; excellent condition. Wheels, also skis and Edo floats. A bargain for cash, no trades. George Arnold, Penasse, Minnesota.

FOR SALE: New Standard D-29A; Kinner B-5 125 h.p. motor, 350 hours total; latest type cylinder heads, Heywood starter. Ship and motor in absolutely perfect condition throughout. Ideal private or training plane. Sacrifice. Location Cincinnati. Russell seat pack, Triangle seat pack, Triangle exhibition pack, reconditioned Aeronca propeller. AERO DIGEST, Box 2036.

GREAT LAKES Sport Trainer: Model 2T-1A, type B; American Cirrus upright engine. Excellent condition. Flown 58 hours. Property of restricted Osage Indian. Now stored Spartan School of Aeronautics, Tulsa Oklahoma. Bids accepted to be opened May 6, 1935. For Information and bid form, write Osage Indian Agency, Pawhuska, Oklahoma.

USED AIRPLANES AND CRACK-UPS: $50 to $10,000. Also motors, parts and equipment. Directory containing descriptions, owner's name and address, only 15c. Aero Bargains, Greenville, Ohio.

FOR SALE: OX-5 Challenger, cracked. Motor 70 hours since new; new prop; full set instruments; price $125. Harold Close, 311 W. 72 St., New York, N. Y.

DH GIPSY MOTH: Licensed to October; full airwheels; racing windshields; Pioneer airspeed; wing slots; total time 550 hours. Recently recovered and top overhauled; excellent condition; $800 cash. W. R. Reese, Box 480, Greensboro, North Carolina.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

PLANES AND ENGINES FOR SALE

AERONCA C-3: NC to 15 October 1935. Enclosure. Heater. Privately owned. Always hangared. $1,000. Now at Essex, Conn. Carlton Brett Morse, Submarine Base, New London, Connecticut.

ENGINES: Guaranteed majored approved agency—Hornet A-1's; Wasp S-1-D-1's; Wasp C-1's; Wasp B's; Wright J6-9, E and D; J6-7, E and D; new J-5; Warner 125 h.p.; Kinner K-5; Lycoming R-680's; Challenger 185 h.p.; Cirrus Mark III; Wright Gipsy. Prices on request. Babb, 1100 Airway, Glendale, California.

TRAVEL AIR SPEEDWING: J-5 engine just majored, fuselage recovered, ship reconditioned, licensed to April 1936; $1,200, consider lighter plane in trade. Fleet Model 2: Kinner K-5, front exhaust, just relicensed, $1,000. Waco cabin: Continental 210, fully equipped, shielded for radio, dual wheels, engine factory majored, price $3,000. Waco 10 left upper wing, recovered, licensed, $50. Scintilla Mag PN5D, $15. Fleet 24-gal. belly tank, $10. Queen City Flying Service, Inc., Lunken Airport, Hangar No. 1, Cincinnati, Ohio.

FOR SALE: American Eagle and Eaglerock just recovered and overhauled. Also Curtiss Robin and Robin with Wright J6-5. All ships licensed. Mobridge Flying Service, Mobridge, S. Dak.

STEARMAN J6-7: Privately owned, best of care, has little time, just recovered and looks like new. Sacrifice, $1,650. J. Drescher, 203 Stevens Avenue, Buffalo, New York.

WACO F WARNER: Like new. OX Curtiss Robin air wheels; Hisso Eaglerock parts; Hisso motor; Waco 10 left upper and lower wings, uncovered; 125 Warner parts; Heywood air starter, complete. Frank Reimers, 314 N. 4th St., Lafayette, Indiana.

AVRO-AVIAN: Cirrus-powered. 250 hours total. Licensed to December. A real buy at $495. Henry E. Oliver, 192 Brown St., Pittsfield, Massachusetts.

WACO CABIN: Wright J6-7. Less than year old; very little time. Just top overhauled by Pan American. Cruises 140; equipped for night flying. Radio shielded. Real performing ship at bargain. Larry Hughes, 2583 Observatory Avenue, Cincinnati, Ohio.

1933 STINSON RELIANT: Beautiful ship, privately owned by wealthy business man. Flown very little, always by select transport pilots. Finest condition and fully equipped including radio. $4,000 cash. Karl Voelter, All American Airport, Miami, Florida.

INTERNATIONAL F-17: OX-5, Millerized. High compression pistons. Dual controls. Just redoped. Price $200. F. Douglas, Box 142, Frankfort, Indiana.

WACO F-2: Continental 165. Just recovered, red fuselage and silver wings; steel propeller, Heywood starter, excellent condition throughout; priced for quick sale at $2,000. Also overhauled J-4 engine for $225. J-5 and J-6 series E parts, cheap. Mackey Flying Service, Findlay, Ohio.

DH MOTH: Licensed July 1935. Airwheels, extra instruments, equipment, hand rubbed finish. Always maintained regardless of cost and in excellent flying condition. $735. Ahlers, 121 Hall of Fame Terrace, Bronx, New York.

TRAVEL AIR E-4000: $1,550. Like new throughout; recovered, finished International orange and Travel Air blue; powered Wright J6-5, modernized and major overhauled; all control surfaces and undercarriage completely rebushed. This work 70 hours back. Bendix wheels and brakes. New over-sized tires. Licensed March 1936. Never cracked. This ship exceptional buy and must be seen to be appreciated. Sell only for cash or trade on three- or four-place cabin. Smith Flying Service, Clarksburg, West Virginia.

OX-5 COMMAND-AIRE: Licensed October, 1935. Scintilla, Millerized, excellent condition. Sacrificed $400. Might trade for 3-, 4-place cabin, pay cash difference. Gordon Dahlberg, 2365 Glencoe Street, Denver, Colorado.

CURTISS OX-5: New motors in original government crates. Price $95 cash, f.o.b. Chris-Craft Corp., Algonac, Michigan.

FRANKLIN SPORT Model: Lambert 90 h.p. Metal prop, semi-air wheels. 325 hours total time, 75 hours since major overhaul. Ship very good condition. Would trade for Stinson or any good automobiles. Clare G. Richmond, Montpelier, Ohio.

PORTERFIELD FLYABOUT: Maryland and Virginia representative. Airplanes or automobiles taken in trade. Time payments. Brand new, $1,595—$1,795. Free instruction to purchasers. Dick Schall, Berwyn, Maryland.

1933 CABIN WACO: Like new. 55 hours total time on engine. Many extras. Priced right. Troy Flying Service, Troy, Ohio.

HUNDREDS OF AIRPLANES: $40 up. Crack-ups, motors, parachutes. Every location. Directory with descriptions, owner's price, name and address; 20c postpaid. Used Aircraft Directory, Athens, Ohio.

USED AERONCAS: Write for list. Want to trade late '34 Lambert Monocoupe for good Stinson, or sell for $2,500. Tred Avon Flying Service, Easton, Maryland.

AVRO AVIAN: Like new; licensed; never damaged, privately flown; always hangared. 215 hours total. $975 cash. Cullen Reaves, State Hospital, Massillon, Ohio.

"PIONEER" offers Warner Stinson, $850. J6-5 Stinson, $1,100. J-5 Stinson, $1,350. Lycoming Stinson, $1,450. 1932 Waco C, $1,675. 1932 Waco C, $2,500. 1934 Waco C, $3,750. Loening Commuter, $1,850. J6-5 Travel Air, $1,350. Kinner Fleet, $1,175. Autogiro, $1,100. Gipsy Moth, $675. Avro Avian, $575. Velie Monocoupe, $565. OX-5 Robin, $450. Travel Air, $475. Waco, $395. Curtiss Jr., $395. OXX-6 American Eagle, $385. OX-5 Eaglerock, $350. Planes priced cash or terms, flyaway present location. Write or wire for preference. "Pioneer," Airport, Syracuse, New York.

FOR SALE: Travel Air 4000, J-5 engine; excellent covering. Steel prop, engine ring. Licensed. $900. W. C. Smith, 220 N. Osage St., Indianapolis, Indiana.

LAMBERT CAVALIER: Sacrifice $1,150, cash only. Latest two-place cabin. Special finish and equipment for show purposes. Gloss white, red trim, looks new, excellent condition. NACA cowling, pants, brakes, metal prop, standard instruments, dual controls, booster starter. Stable, fast, economical. Privately owned, never damaged. Air time 211 hours. Licensed to November, 1935. Cost $3,975. Wire C. F. Williams, Miami, Oklahoma.

ROBIN: Challenger motor. Total time 243 hours; in perfect condition; always hangared, never cracked; privately owned. $1,000. Robertson Airplane Service Co., Robertson, Missouri.

TRAVEL AIR 6000-B: $1,650. J-6 fine shape, licensed to December. Blind and night flying equipment. Never damaged. H. T. Olden, 42 Taber Street, Fairhaven, Massachusetts.

FOR SALE: Stinson Reliant, purchased September, 1933. Like new; 230 hours. Radio, landing lights, flares. Privately owned. Instruction free. C. Clabaugh, 2325 N. Trip, Chicago, Illinois.

185 H.P. CHALLENGER ROBIN: Relicensed; full air wheels, brakes, adjustable prop, plush upholstery. Excellent condition. 335 hours. Majored. Have purchased larger ship. Price $875. Will consider trade late Aeronca. Wilson Flying Service, Boiling Springs, Penna.

1933 STINSON RELIANT: Like new. Special paint, landing lights, flares, large gas tanks, NACA cowling, pants, Lear radio, bank and turn, rate of climb. Always hangared, privately owned; used for business and pleasure only. 280 hours total; 80 hours since factory major; motor brought up to present standard. A good buy for cash. Webb Oil Co., Tracy, Minnesota.

FOR SALE: Waco F, Kinner-powered; majored; turn and bank. $1,500. Decatur Flying Service, Inc., Lock Box 495, Decatur, Illinois.

FAIRCHILD 24: Powered with Warner 145. Has starter, landing lights, and flares. Only 8 weeks old. 70 hours total time. Cost $5,235. Will sell for $4,385 and will accept your ship in trade. Please give complete description of your airplane in first letter. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

FOR SALE OR TRADE: Lycoming Stinson Jr. Major overhauled American Airways engine; total time 10 hours; new fabric; excellent condition. Challenger Robin: Complete recover job; new fuselage; major overhauled motor; no time on ship or motor since overhaul. Complete Lycoming motor less cylinder barrels and pistons. Arthur Currey, Airport, Monmouth, Illinois.

J-5 BUHL AIRSEDAN: 5-place; 75 hours since major and recovered; Heywood starter, steel propeller. Arrow Sport: LeBlond 60, 270 hours total one owner. J6-5 Eaglerock: 450 hours; 12 hours since major; steel propeller, speed ring. All priced to sell quickly. AERO DIGEST, Box 2024.

CURTISS-WRIGHT JUNIOR: Licensed and in good condition. Cover like new. $390 cash. L. W. Graham, 502 East Ferguson Street, Tyler, Texas.

FOR SALE: LeBlond 70 aircraft engine, completely overhauled and in A-1 condition. 300 hours since new. $175, F.O.B. Austin. Epbie Hull, Austin, Minnesota.

DE LUXE WACO CABIN: '32 model, 210 horsepower, many extras including ambulance equipment; $2,800. Also, Fairchild 22: Clean job, just relicensed, $1,400. J. T. Moore, Jr., Reading, Pennsylvania.

4-PLACE BIRD: Kinner B-5 motor, 330 hours, just majored. Heywood starter, metal propeller, new special finish, Pioneer panel, extra instruments, semi-airwheels, brakes. Manufactured November, 1931. Licensed to March, 1936. Never cracked; perfect condition. $1,575. Kenneth Wright, Harmony, Pennsylvania.

BEECHCRAFT: Perfect condition. J6-9 Whirlwind engine, total 350 hours; 50 hours since major. Hamilton adjustable pitch propeller, complete blind flying and navigation instruments, five flares, electric generator, radio and four seat parachutes. Cruising range, 1,000 miles at 170 m.p.h. cruising speed. Ethyl Gasoline Corporation, Chrysler Bldg., New York, N. Y.

LAMBERT MONOCOUPE: Racing type landing gear, steel propeller, semi-airwheels and brakes. Less than 100 hours total time. Best offer over $1,200. Babe Alsworth, Sherburn, Minnesota.

CONTINENTAL 165 VERVILLE: Metal prop, Heywood starter, Airwheels, brakes, tailwheel, navigation lights, Pioneer bank-turn, dual instruments. Excellent condition, always hangared, licensed to October. Sacrifice, $975. F. J. Kirk, Box 68, South Lancaster, Massachusetts.

FOR SALE: 4000 Travel Air, Warner-powered; American Eagle, Kinner-powered; OXX-6 Waco 10, many extras, being newly covered throughout; Waco Cabin, cracked up, priced right. Dunaway Garage, 2201 Indiana Avenue, Kansas City, Missouri.

J-5 EAGLEROCK: Equipped for sign towing. Twenty-five hours since complete overhaul and recovering. Consider smaller ship and cash. Delbert Whitten, Roosevelt Field, Garden City, New York.

AERONCA C-3: Just completely recovered and rebuilt. Same as a new airplane. Engine recently majored. $875. Several others. Send for list. Air Activities Airport, West Chicago, Illinois.

FORD TRIMOTOR: J6-9 motors, all fully modernized; recently majored by Curtiss-Wright. Best money making Ford in country. Looks perfect, with latest type lowered motor mounts, Wasp undercarriage, 44 x 10 Bendix wheels, hydraulic brakes. 11 new aluminum passenger seats. Excellent condition throughout, nothing needed. Licensed October 1935. Worth $10,000 Sacrifice for quick cash sale. Now flying daily in West. Picture and details, Western Airplane Distributors, 600 Graphic Arts Building, Kansas City, Missouri.

WILL SELL OX ROBIN: Excellent condition, for $475 and teach buyer to fly free. Franklin Flying Service, Franklin Airport, Turners Falls, Massachusetts.

WACO C: 1932, 210 Continental; always privately owned. Extras include Sperry horizon. This ship in excellent condition throughout—a real buy, $2,500. Fleet: Kinner K-5, modernized; air starter, full airwheels, brakes, leather upholstery. Completely rebuilt May 1934. Excellent condition; $1,350. Both of these ships must be seen to be appreciated. White Flying Service, Caldwell-Wright Airport, Caldwell, N. J. Phone: Caldwell 6-1560.

STINSON DISTRIBUTOR will take any licensed airplane in trade on new Stinson; give description of plane for estimate. For sale: Reliant; night and blind flying equipment, leather upholstering, large gas tanks, $3,750. Brayton Flying Service, St. Louis Municipal Airport, Robertson, Missouri.

BOEING BIPLANE: Good condition, new Liberty motor—latest type. Fine for cargo, advertising, advanced instruction. Cash or trade; give or take difference. AERO DIGEST, Box 2030.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

PLANES AND ENGINES FOR SALE

J-5 STEARMAN: Model CB3, in excellent condition. Total time on ship and motor, 575 hours. Equipped with bank and turn, rate of climb, compass, storage battery, starter, large landing lights, front cockpit cover, and semi-airwheels with brakes. Price, $1,250. Will consider trade-in. Andy Stinis, Floyd Bennett Field, Brooklyn, New York.

FOR SALE: Warner and Cirrus Fairchild 22's. Fairchild 24. Lambert and Warner Monocoupes. J6-9 open Travel Air. Bellanca Pacemaker. Bellanca Skyrocket. Lockheed Vega. Wasp Laird. Stinson S. Stinson Reliant. Waco F-2. J-5 Stearman. Challenger Robin. Jacobs Beechcraft. Waco Cabin. Aircraft Sales Co., Roosevelt Field, Mineola, New York.

SAVOIA-MARCHETTI 3-place amphibion, completely rebuilt, recovered; less engine; less than 40 hours since new; also rebuilt Savoia parts. Also, Aeronca E-107A engine, just majored; bargain. Wanted: Aeronca C-2 fuselage and tail surfaces. Bunyard Aircraft, 25 Randall Place, Pelham, New York.

OX-5 CHALLENGER in A-1 condition. Licensed December 15th. $500. Deliver anywhere for expenses. Fred Vilsmeier, 861 E. Luzerne St., Philadelphia, Pennsylvania.

BELLANCA PACEMAKER: J6-9. Engine in good condition. 170 hours since completely recovered and refinished. Priced for cash sale; no trade. Merrill C. Morgan, P. O. Box 136, Oklahoma City, Oklahoma.

PITCAIRN AUTOGIRO PCA-2: Modernized Wright F, 300 h.p. Total time 250 hours; 20 hours since major overhaul. Extra oil radiator and sign release. Relicensed September first. Perfect flying condition. $3,000. Also: complete sign-towing equipment, including 154 9-foot letters, $500; or both for $3,200. Frank Sagley, 1854 Eastern Parkway, Brooklyn, N. Y.

WACO C: 165 Continental; perfect flying condition; just relicensed; landing lights, flares; wind-driven generator; with Lear radio, $1,900; without radio and generator, $1,750. Frank Sagley, 1854 Eastern Parkway, Brooklyn, New York.

WACO TAPERWING: Excellent condition; late type J-5; $1,350. Will swap Taperwing struts and wires for set of Straightwing. Waco OX-5, model 90: 15 hours since completely recovered and motor overhauled; Miller overhead; $450. Wanted: One set of Edo 3300 or 2660 floats. Jack Loesing, Floyd Bennett Field, Brooklyn, New York.

BARGAINS IN USED PLANES: Stinson-Reliants, Model R and SM8A. Fairchilds—22 and 24. Kinner low wings, 100 and 125 h.p. Gee Bee biplane. Bird with 170 h.p. Jacobs motor. Buhl monoplane, Wasp C motor, like new; sacrifice price. Stearman, J-5 Wright. E. W. Wiggins Airways, Inc., Providence, Rhode Island.

WARNER 125 MONOCOUPE: 370 hours. racing landing gear, $1,700. Warner 125 Monocoupe: 440 hours, racing landing gear, $1,350. Lambert Deluxe Monocoupe: 70 hours, practically new, $2,700. Lambert Monocoupe: 395 hours, racing gear, wheel pants, $1,600. Lambert Monocoupe: 500 hours, racing gear airwheels, $1,450. Lambert Monocoupe: 490 hours, oleo gear, $1,350. All ships subject to prior sale and prices quoted flyaway St. Louis. Lambert Aircraft Corporation, Robertson, Missouri.

FOR SALE: Kinner B-5 Pitcairn PAA-1 2-place autogiro; perfect condition; total time on ship 100 hours, motor 63 hours. $1,500. No dealers. Standard Aviation, Inc., Teterboro Airport, Hasbrouck Heights, New Jersey.

MONOCOUPE: Warner 125 h.p., only 260 total hours, 50 hours since completely overhauled. Never cracked up, always privately owned. Equipped with ring and racing landing gear. Truly excellent condition throughout; licensed to April 1936. Price, $2,100. Located Hangar 3, Floyd Bennett Field. No agents. AERO DIGEST, Box 2045.

WACO: 6 hours since complete overhaul, recovery, relicensing. OX, 36 hours total. Finished black and silver. Best cash offer or trade, car or boat. AERO DIGEST, Box 2043.

CHALLENGER OX-5: Recently recovered. 30 hours since major on motor. Scintilla magneto. Air speed, compass. $575 for quick sale. A. G. Becker, Bettis Airport, Dravosburg, Penna.

FAIRCHILD 34: $800; 50 hours since major. Taylor Cub, just majored, $750. Stinson, Lambert Monocoupe, many others. Aviation Clearing Co., Mineola, Hangar 32, Roosevelt Field, Mineola, New York.

13 AIRPLANES FOR SALE OR TRADE: 2 J-6 Travel Airs; J-5 Travel Air; 2 OX Travel Airs; 2 J-5 Straightwing Wacos; Warner Waco F; OX Waco; 6-place J-6 Stinson; Driggs Skylark, Rover-powered; Lambert Cavalier Coupe; Heath, powered with Wright Morehouse. Will sell J-5 ships with or without motors. Trade in your ship or will accept cars of late model. Terms if desirable. Two almost new silk Irvin seat parachutes. Steel propellers for J-6 and J-5. Few brand new Hamilton wood props at $15. Flottorp, Marshall, and Bennett carried in stock for all motors. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

VELIE MONOCOUPE: Long wing, licensed. Beautiful job, new pyralin, motor good. $565. OX Waco, $265 flyaway. Instruction free to buyers. Monty Barnes, Municipal Airport, Wichita, Kansas.

GOOD USED SHIPS: All licensed and in good condition. Warner Cessna: Fully equipped, excellent condition, $1,075. Warner Stinson Jr., a sweet little airplane, 4 passengers, $750. OX Travel Air: Semi-airwheels and brakes, $500. OX Robin: Just refinished, $500. Fairchild KR-21, excellent sport or trainer, $975. Savoia-Marchetti: 125 Kinner, three-place amphibion, good performer, excellent condition, $1,175. Curtiss-Wright Jr., 48 hours since overhaul, $400. J-5 Pitcairn Mailwing: blind flying instruments, radio, 40 hours since major, excellent banner-towing ship, $1,450. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

KINNER ENGINE: K-5, just majored; in perfect condition, $250. E. Closs, Sparta, New Jersey.

TRAVEL AIR 2000: Excellent condition throughout. Semi-airwheels, brakes; sporty paint job. Best buy in this class at $550. Roger Pennock, 501 Cooper Street, Camden, New Jersey.

SAVOIA - MARCHETTI amphibion: Recently overhauled, recovered, relicensed. Make cash offer, or will take cabin cruiser, automobile or light plane in trade. Send details. AERO DIGEST, Box 2042.

FLEDGLING CURTISS: Challenger motor. Airplane and motor completely overhauled. Painted in Army colors, rubbed high gloss finish. Will consider trade. A. G. Becker, Bettis Airport, Dravosburg, Pennsylvania.

FAIRCHILD 22: Just relicensed. 30 hours since major. 360 total hours on airplane and motor. Priced for quick sale, $1,250. Need cash. Walter Hartman, Bettis Airport, Dravosburg, Penna.

MONOCOUPE: Lambert de luxe flap model. Warner Monocoupe, $1,100. Warner Fairchild 24, $2,100. Others. Aviation Clearing Co. of Mineola, Inc., Hangar 32, Roosevelt Field, Mineola, New York.

FLYING BOAT: Twin hull Savoia-Marchetti; useful load, 5,500 pounds; as is, in need of major overhaul, $500 cash. Sister ship in perfect flying condition, like new, NC licensed, $5,500. E. Closs, Sparta, New Jersey.

WANTED TO BUY OR TRADE

WANTED: Two upper wings and one right lower wing, all with ailerons, for Keystone Commuter. State price and condition. Charley Collar, P. O. Box 1847, Miami, Florida.

WANTED AT ONCE for cash: J-5 Waco, Travel Air or Fleet, or similar ship. Give full description and best price first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

$300 FOR AERONCA or other similar job, delivered to John W. Patton, 2139 Eye St., N. W., Washington, D. C. Must fly.

WANTED: Aerial camera in good condition; will pay cash. Please describe fully in first letter. Charles J. Farmer, E. Church St., Eden, N. Y.

WANTED: One set Edo floats, size 3300, in perfect condition, and fittings for Stinson SM8A. Cash proposition. Warren O. Russell, Petersham, Mass.

WANTED: Scintilla magneto, complete with bracket and gear housing, for OX-5 engine. State condition and price first letter. Kenneth Hoequist, Route 1, Orlando, Florida.

WANTED: Late model Lambert Monocoupe, in good condition. Give description and lowest price. AERO DIGEST, Box 2017.

HAVE CASH for new or used American Cirrus motor. Must be priced right. Give honest and accurate information in first letter. Battlefield Airways, Gettysburg, Pennsylvania.

WANTED: OX-5 Travel Air that is convertible to a J-5 engine. Eugene A. Cole, South Court Street, Medina, Ohio.

WANTED: Szekely SR3O. Must be in good condition. State lowest cash price. Box 946, Shawnee, Oklahoma.

WANTED: Licensed 4-place cabin ship, about 200 h.p. Brakes, starter, duals (2 wheels) essential. Prepared pay maximum $2,000, f.o.b. New York City. Send fullest particulars, dimensions, performance (including take-off and land) consumption, hours, history and photos. Describe additional equipment, if any: e. g., blind flying instruments, drift sight, radio, silencer, slots or flaps. Potter, P. O. Box 362, Pietermaritzburg, South Africa.

WANTED AT ONCE for cash: Good J-5 motor, propeller and starter. Give full description, hours and best price first letter. Michigan Aero Motors, Jackson, Michigan.

WANTED TO TRADE: A 7-room cottage house, heat, lights, bath, two-stall garage, on corner lot; for a 4- or 6-place cabin plane. M. Hardy, 16 Hanford Place, Tarrytown, New York.

WANTED: Light plane. Must be licensed; duals and under $450. Prefer Robin, Waco 10. What have you? Sidney Flying Service, Box 834, Sidney, Montana.

WANTED: 2- or 3-place light open plane. Licensed. Flyaway. Air-cooled, duals and brakes. Prefer biplane. Give complete details. Robert S. Diehl, Manheim, Lancaster County, Pa.

WANTED: Late model bubble sextant; radio transmitter and receiver for long-distance ship. AERO DIGEST, Box 2046.

WANTED: Set of four or separate wing panels for 2000 Travel Air; describe completely and state lowest price f.o.b. Or will sell OX Travel Air, complete, less wings. Dufort Flying Service, Inc., Malone, New York.

WILL BUY J-5 Waco, Travel Air, Stearman or Pitcairn, less motor. Condition of fabric immaterial, but must be bargain for cash. Florida Skyways, Inc., Miami, Florida.

CASH for Stinson S, in good condition. Give time, details, lowest price. W. A. Olsen, City National Bank & Trust Co., 208 S. La Salle St., Chicago, Illinois.

WANTED: J-5 motor; state price, condition and history in first letter. Albert Grazioso, 647 Valley Road, Clifton, New Jersey.

WANTED: Kinner K-5 low-wing Sportster. Also J-5 Taperwing. Give full description, lowest cash price, snapshot, first letter. Indiana Air Service, Bendix Municipal Airport, South Bend, Ind.

WANTED: Bellanca 330 h.p. at once for cash. Give full information, price and details first letter. AERO DIGEST, Box 2040.

WILL PAY CASH for airplanes, engines or parts in any condition. Write complete details, prices, etc., in first letter. J. E. Poission, 1219 Penn St., Grand Rapids, Michigan.

HAVE BEAUTIFUL 3¼ carat diamond ring, value $1,200, and some cash for good licensed, air-cooled ship. What have you? AERO DIGEST, Box 2039.

WANTED: Used Tank Model 73 engine; would buy late model Waco 90. Prefer private hangared ship. Also want good used Szekely Model O engine. Merle Isaminger, Bismarck, North Dakota.

WANTED: Warner Cessna with steel prop; balloons; Friese ailerons; licensed. Pay cash. Give detailed description and serial numbers first letter. Stanley Fuller, Milford, Iowa.

WANTED: Robin left wing. Challenger Robin prop, landing gear struts, stabilizers. For sale: Challenger Robin, new fabric, motor majored, relicensed. Will trade. Ray Vaughan, 77 Morningside Drive, Akron, Ohio.

WANTED: Good licensed air-cooled two or three-place ship; must be good condition; no crack-ups. Give full details, cheapest cash price first letter. Jim Ward, Harlan, Kentucky.

HAVE CASH for three-place air-cooled open job; must be bargain. Call or write Noble Mills, 4142—42nd Street, Long Island City, New York. Telephone: Stillwell 4-0998.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

WANTED TO BUY OR TRADE

TRADE: Midget front wheel drive racing car for flying boat or pontoon job. Consider land job, not over 125 h.p. Plane must be licensed. No junk. Yager, 6 Morriss St., New Rochelle, New York.

WANTED TO TRADE: My 1934 V-8 Ford de luxe coach, 7,000 miles, radio, 4 months old, perfect shape, for airplane of near value. Irvin Tounsley, 1295 Latham, Memphis, Tennessee.

WANT small amphibion. Must be licensed and in perfect condition. Give complete description, picture and lowest price in first letter. Write Box 696, Paducah, Kentucky.

WANTED: Warner- or Lambert-powered Monocoupe. Must be a good buy. One equipped for inverted flying preferred. AERO DIGEST, Box 2037.

WANTED AT ONCE: Pontoons for Challenger Robin, complete with undercarriage. Give full details with price. Address Roger L. Smith, Aerial Transportation, Coaticook, Que., Canada.

WANTED: Diesel motor for school instruction purposes. Aeronautical University, 1338 South Michigan Avenue, Chicago, Illinois.

WANTED: Wheels, 850 x 10—2-3/16 axle, with brakes, bearings and pants, if available. Berling mag, booster; late compass, directional gyro. 2043 Spring Garden St., Phila., Pa.

WANTED: AUTOGIRO, 2 or 3 place; also sensitive altimeter and gasoline rate of flow meter. Send complete information to AERO DIGEST, Box 2041.

WILL PAY CASH for light plane with or without floats. State price. Box 727, Boulder City, Nevada.

THREE absolutely new de luxe 1935 Ford coupes and coaches. Will trade for licensed airplanes. Also 1929 Packard Coupe, few miles, and 1933 Ford coach. Finance Co., Hemlock, New York.

MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

WANTED: European representation authentic aeronautical firms; anything from bolts to planes; living Europe, entree all aeronautical circles; interview can be arranged; references exchanged. AERO DIGEST, Box 2002.

LEARN TO FLY: Solo flight, $50. Limited commercial, $250. Transport, $800. Decatur Flying Service, Inc., Decatur, Illinois.

FREE STORAGE: Do you need cash? Let me sell your ship on my free storage plan. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

UNUSUAL OPPORTUNITY for man with financial backing to participate in aerial prospecting trip in South America. Possibilities are unlimited and permanent. AERO DIGEST, Box 2028.

COME TO NEW JERSEY to fly. Near New York and the seashore. $50 to solo; transport course, $880. LC and private, $250. Amateur, $175. New planes. Best instruction. Write for booklet. Central Jersey Airport, Hightstown, N. J.

AIRPLANE MANUFACTURER (East coast) wants simplified motor, 80-120 h.p. Low production, maintenance, operation costs. Describe motor and production facilities, if any. AERO DIGEST, Box 2026.

LEARN TO FLY: $3 per hour solo. $6 dual. No club. Pay as you fly. Air-cooled licensed equipment. Barnes Flying Service, Municipal Airport, Wichita, Kansas.

WONDERFUL OPPORTUNITY for live operator. Student training, cross country and local passenger carrying. Transcontinental Airport, Toledo, Ohio.

THE U. S. AERO UNITS will teach you how to fly at the lowest cost. No dues, membership or registration fee. Pay as you fly! We will place a new ship at your airport. Write for description of plan. Units are now operating and being formed all over the country. U. S. Aero Units, Inc., 122 E. 42 St., New York, N. Y.

OPPORTUNITY: Get your transport course for $750 cash and work for the balance. Write for information. Conrad Flying Service, Winona, Minnesota.

MECHANIC: A & E licensed, Air Corps, airline and aircraft factory overhaul shop experience, wants to rebuild ship or crack-up. Reply Box 2, Curtiss Bay, Baltimore, Maryland.

SPRING IS HERE! Edwards Flying Service—Aeronca distributor for Metropolitan New York, New Jersey, Westchester, Long Island for 1935 land- and seaplanes—want you to own your own ship. New time payment policy, which makes it easy for you to own a new 1935 land- or seaplane. Or fly 1935 equipment at $3.50 solo, $5.50 dual. Dealers wanted. Come out to Flushing Airport, only 30 minutes from Grand Central Subway; or phone INdependence 3-4843.

DESIGN WANTED: A good two-place cabin plane, to be manufactured on a royalty basis. Stress analysis preferred, but not necessary. 239 Oakland Park Avenue, Columbus, Ohio.

AN EXPERIENCED English aviator solicits the representation in England of American manufacturers of planes; parts and accessories. Address in the first instance, L. C. Johnson, Hotel Croydon, 12 E. 66th Street, New York, N. Y.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

BARGAIN: We have 10,000 ft. of Chrome-moly seamless steel tubing, all Air Corps 57-180-2-C specifications of various wall and diameters. Will sell entire lot at low figure or will sell piecemeal at slightly higher figure. Also supply 1025 sheet steel of various gauges. Vermilya-Huffman Flying Service, Lunken Airport, Cincinnati, Ohio.

WAR RELICS for clubhouse or den. Vickers aircraft machine guns; cost government $700; rendered unserviceable without marring. Only $7.75 each, (f.o.b. N. Y.). Sent C.O.D. on payment of $1. Weight 33 pounds. Fiala Outfits, 47 Warren St., New York, N. Y.

SPECIAL TOOLS: For overhauling Scintilla magnetos. Complete except charger. Blueprints. Service manuals. Many new spare parts. Cost approximately $350. What will you offer? Jimmy Romberger, 206½ Washington Ave., Endicott, New York.

ENGINE PARTS: Curtiss Challenger main case, master rod, and other parts; J-5 main case, crankshaft, cylinders, etc.; Velie M-5 cylinders, crankshaft, valve action, magnetos, carburetor, front and rear case. Szekely propeller hubs, rod lock rings, SR-3 crankcase, Scintilla mags, gears, miscellaneous parts. Set Lambert 90 cylinders, pistons, steel propeller. Warner master rod, pistons and pins, crankshaft, rear case, push rods, intake pipes. Cirrus parts. OX-5 cylinders, crankshaft, case, miscellaneous parts, cheap. Dunaway Garage, 2201 Indiana Ave., Kansas City, Missouri.

ENGLISH CIRRUS ENGINE: With extra set of heads; 22 x 10-4 Goodyear hubs; 8.50 x 10 fenders; 32 x 6 wheels, tires and tubes; lower left Fledgling wing; reconditioned pair J-5 blades. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

BROTHER, Can you spare a dime? If you can, send it to me and I'll send you my 1934 Low-Priced Aviation Material Catalog. Karl Ort, 620 W. Poplar, York, Pennsylvania.

COMPLETE Fleet belly gas tank assembly. Fleet shatterproof glass winter enclosure. Will trade for complete set of brakes to fit 22 x 10-4 Airwheels, or sell outright. Harold L. Alford, Blue Bird Hangar, Chicago Municipal Airport, Chicago, Illinois.

STOP WASTING TIME and money. Our new Dopex dope and lacquer remover does it in half the time with less work; wax free. Sample on request. Air Transport Equipment, Garden City, New York.

J-5 ENGINE: Completely overhauled and modernized with clutch, new type pistons and Timken bearings in rocker arms, $500; J-6 cylinders, reconditioned, $25 each; J-6 overhauled magnetos, $25 each; J-5 engine, good condition, $350; Kinner K-5 main case, good condition, $40; many other reconditioned engine parts offered at substantial saving. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

LE BLOND MOTORS. A-N dope, 80c/gal. Propellers: Hisso $10; Warner, OX-5—steel $65. Bank-turns, $35; other Instruments. New replacement tailwheels. Klemm, Eaglerock, American Eagle, Swallow wings—parts. All types starters. Want J-5 parts. AERO DIGEST, Box 2031.

TAYLOR "CUB" flying, eight by ten photograph; detail three-view blueprint, 10c each. Both 15c (stamps). Taylor Aircraft Company, Bradford, Pennsylvania.

WRIGHT GIPSY engine: Total time approximately 200 hours. Just top overhauled. Also set 20 x 9 Goodyear Airwheels with brakes. Cheap for cash. D. C. Flower, Troy, Ohio.

SHOCK CORD: Guaranteed new. ⅝", $.08. ½", $.06. ⅜", $.04. 100 feet or over sent postpaid. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

NEW WRIGHT GIPSY engines and parts: R. J. Wenger, 6718 McKinley Avenue, Los Angeles, California.

FOR SALE: Licensed Waco 10 wings and parts. Wanted: Crack-ups and parts, any make. Repair work; licensed mechanics. Air Trades, 3826 Gladys Avenue, Chicago, Illinois.

IF IT FLIES WE HAVE IT: 250 weather-proof Navy flying suits, with zippers front and legs (cost $20) now $3.75. 10 x 3, 500 x 3, 500 x 4, 14 x 3 tires, tubes and wheels, $7.50 each. 24 x 4, 26 x 5, 26 x 3, 28 x 4 straight-side non-skid tires, $3.50 each; larger sizes, $5 each. Wire wheels, from $1 to $3 each. Standard steel propellers: Velie, Kinner, Wasp, and Hornet, $75 to $150. Parts for Wright Cyclone R-1820-F. New 1750 Cyclone, new Wasp and Hornet motors and parts for all makes of motors. Generators, starters, valves, exceptionally low prices. Liberty, Hall-Scott, Mercedes, Hisso's, Lawrance, Cirrus and other makes of motors, $50 to $150 each. Siemens-Halske new radial motors, in original crates, 70 h.p., $250 each. Practically new L-head Aeronca motor, $140. Motor generators, 10 volt input, 300 volt output, $10 each. New Fahrenheit temperature gauges, 12-foot tubes, $1.90 each. 3½-inch dial 20,000 foot new altimeters, $3. B. G. 4-B spark plugs, 50c each. AC, Champion, Splitdorf, 25c each. Turnbuckles, shackles, clevis pins, cloth, dope, nickel steel bolts, exceptionally low prices. 10 x 3, 14 x 3, 20 x 4, drop center wheels, $3.50 each. Bank and turn indicators, $35. Aerial mapping cameras, $100. Silk Irvin parachute with pack, $75. Instruments of all kinds. Gunners' safety belts, 50c each. Standard steel blades, $35. B-2 and B-3 engine throttles, $2 and $3.50 each. Engine primers, choke control, 50c each. Parker and other fittings, 70% off. 4-, 6-, 9-, 12-cylinder Scintilla magnetos, $25 each. 100 pairs new O. D. Army breeches, $1.50 pair. Set of 7 small ignition wrenches, in case, 22c. Variable pitch Hamilton propeller, best offer. Tachometer, $7.50. G E compasses, $5. Oil or air gauges, $1. See us for bargains. Crawford Airplane Supply Company, Venice, California.

FOR SALE: J6-9 motor; Lycoming motor; cracked-up Laird; artificial horizon; Monocoupe and Fairchild parts. Aircraft Sales Company. Roosevelt Field, Mineola, New York.

AVRO AVIAN PARTS: Wings, landing gear, tail, etc.; new English Cirrus motor only 40 hours total time, $80. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Penna.

KINNER PARTS cheap, good condition. Cylinder, side exhaust, valves, rocker arms; B. G. plugs, $10 complete. 129 Eagle parts: V's, ailerons, stabilizer, flippers, etc. A. Jackson, Route 3, Brainerd, Minnesota.

FOR SALE: B-5 Ryan wing, covered like new, $300. Wanted: J-6 Ford and J-6-9 air starter; will trade in inertia. Roger Mensing, 1218 Jones St., Fort Wayne, Indiana.

HEATH WELDED FUSELAGE: Wing ribs. tanks, other fittings. Henderson B-4 motor. Stored 2 years. Price $150. Third down, or $135 cash. Harvey K. Bonsteel, Jamaica, L. I., N. Y.

WING SALE: Large stock of rebuilt wings for all makes of airplanes; also struts and landing gear parts. N L Aircraft Co., Vermilion, Ohio (formerly New London Aircraft Co., New London, Ohio).

EASTMAN K-5 aerial 12-inch lens, with oblique vertical mounts, guaranteed, $250 cash. Ray Applegate, Rose Aeroplane Co., 4439 North Clark, Chicago, Illinois.

SIKORSKY S-39 HULL, wings, center section, tail group, undercarriage, pontoons and various other parts: Never used and in fine condition. To be sold at approximately half of cost price. AERO DIGEST, Box 2044.

FLIGHTEX "A" wing covers: American Eagle, Swallow, Travel Air, Waco, etc., $10. Fuselage covers, $12. Others proportionately. OX-5, OXX-6 parts, bought and sold. Ostergaard Aircraft, Parr, Indiana.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

POSITIONS WANTED

TRANSPORT PILOT: 7 years experience instructing, barnstorming, testing, servicing. One year in South America. Speak Spanish. Will go anywhere to work hard. Own licensed biplane. Clean record. References. Salary secondary. 2nd Lieutenant Reserve Air Corps, AERO DIGEST, Box 2015.

STUNT PILOT: 2 years practical experience. Desires exhibition, demonstration, or advertising flying. Will fly anything with wings that has enough power to take off. No reasonable offer refused. Now employed. 27. Married. References exchanged. Correspondence confidential. AERO DIGEST, Box 2021.

TRANSPORT PILOT: A & E mechanic, radio operator, experienced cross-country, night, radio beam and blind flying. Want position with future. Salary secondary. Excellent references. AERO DIGEST, Box 2020.

TRANSPORT PILOT desires position, with or without ship, with company or private party. Have 3-place open ship. References on request. Go anywhere. AERO DIGEST, Box 2019.

ENGINEER: 10 years experience design, construction flying boats and land-planes. Expert stress analyst. Seeks responsible position offering future opportunities. AERO DIGEST, Box 2018.

TRANSPORT PILOT: 1200 hours. Experienced in instruction and cross-country flying, single, and will go anywhere. Fremont C. Rohrer, Cochrane, Wisconsin.

TRANSPORT PILOT (New Jersey) has errand California. Will fly you, your guests, your ship round trip, teach flying en route. Offering services for transportation. Suitable cabin airplanes purchaseable $1,500-$2,000. Leave about May 20. AERO DIGEST, Box 2034.

TRANSPORT PILOT going as passenger first U. S.-Honolulu scheduled flight wishes commission or assignment of any kind. Interview New York or Philadelphia. AERO DIGEST, Box 2035.

TRANSPORT PILOT and mechanic: 4 years' flying experience, clean record, wishes position as instructor, airport manager or barnstorming tour. 30, married, willing to go anywhere. AERO DIGEST, Box 2033.

LIMITED COMMERCIAL PILOT: 300 hours open and closed models. American, 25 years of age, married. Desires any position in the industry. Best references. AERO DIGEST, Box 2032.

PILOT (Transport): Salesman, executive—the United States is my backyard. At present employed but want to change. Acquainted with entire aircraft industry. What have you? AERO DIGEST, Box 2025.

TRANSPORT PILOT: Competent instructor, airline experience; over 5 years flying, maintenance and airport management. Ambitious and hard worker. Age 28, excellent references. AERO DIGEST, Box 2022.

TRANSPORT PILOT: 32 years old, college education, married. Private and professional flying experience. Eleven years sales and business experience. Particularly interested in contacting executive desiring secretary-pilot, or aircraft factory wanting pilot-salesman. Ira J. Sellers, Jr., Quinlan Castle, Birmingham, Alabama.

PARACHUTES FOR SALE

PARACHUTES: Approved types bought, sold, exchanged, repaired, packed, rented. Specify fully requirements. Airports should investigate drawing power of balloon and inexpensive operation for Sunday business. Thompson Bros. Balloon & Parachute Co., Aurora, Ill. Established 1903.

IRVIN PARACHUTE: White silk, new, never worn, $150. Switlik exhibition chute, white silk, 26 back, 24 chest; will give terms. Pioneer Aviation, Airport, Syracuse, New York.

FOR SALE: 24-foot Switlik parachute, seat pack, perfection condition, complete with carrying bag. $100. F. M. Herdrich, 901 Electric Building, Indianapolis, Indiana.

HELP WANTED

REPRESENTATIVE in your community to sell flying courses of established school near New York. Low prices and other good features. Give references when applying. AERO DIGEST, Box 2027.

GLIDERS

PRIMARY GLIDER: Welded V-fuselage, folding wings, V-landing gear; condition perfect, never cracked; flies perfectly. Cash, $85. Moore Flying Service, Box 753, Dayton, Ohio.

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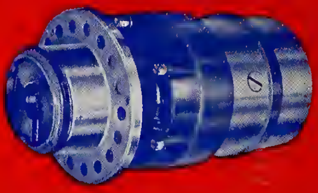

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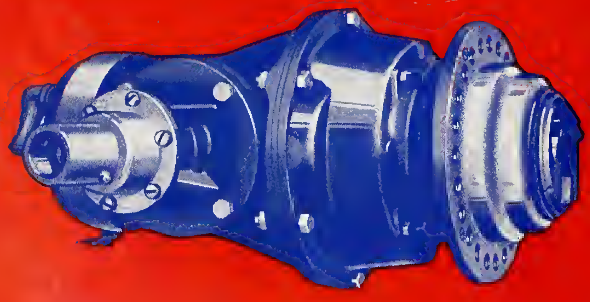

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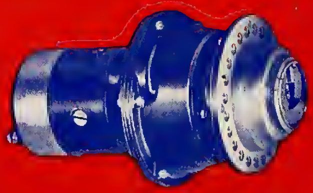

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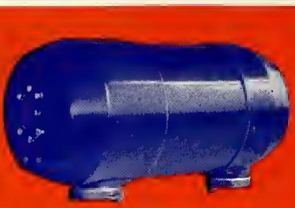
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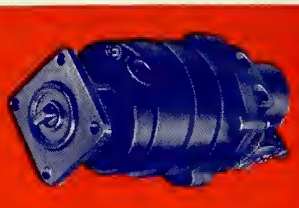
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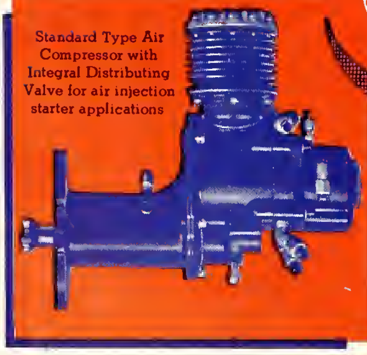
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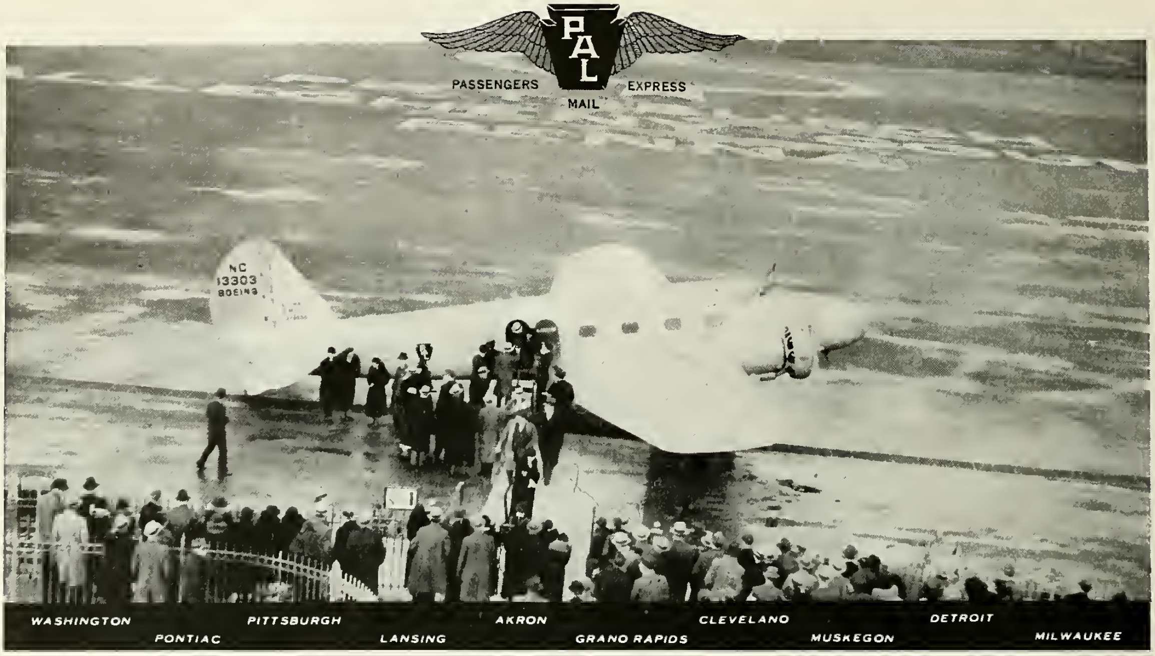

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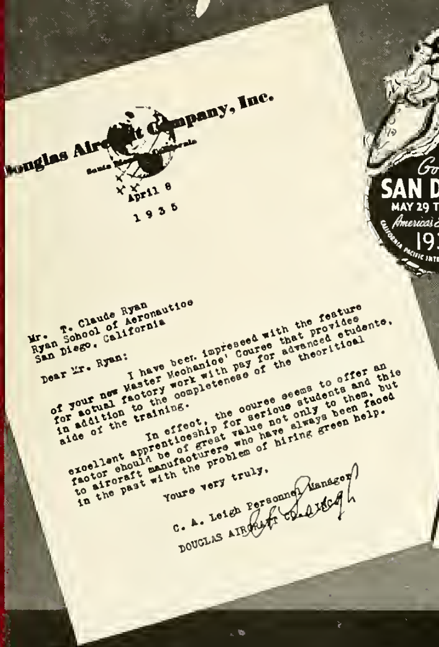

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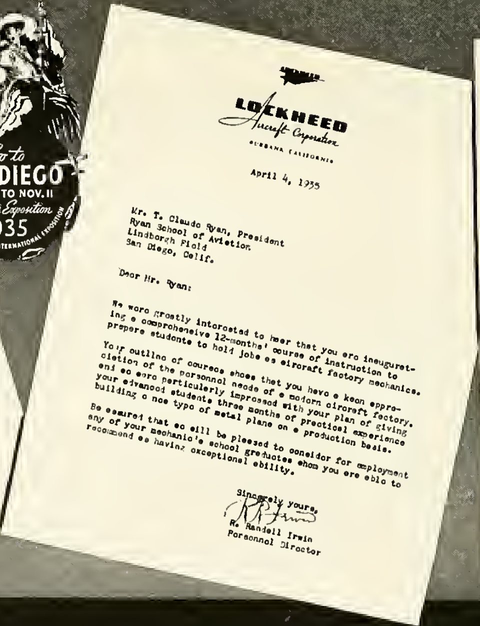

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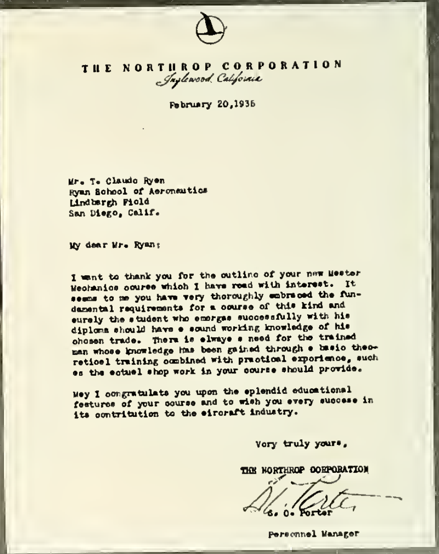

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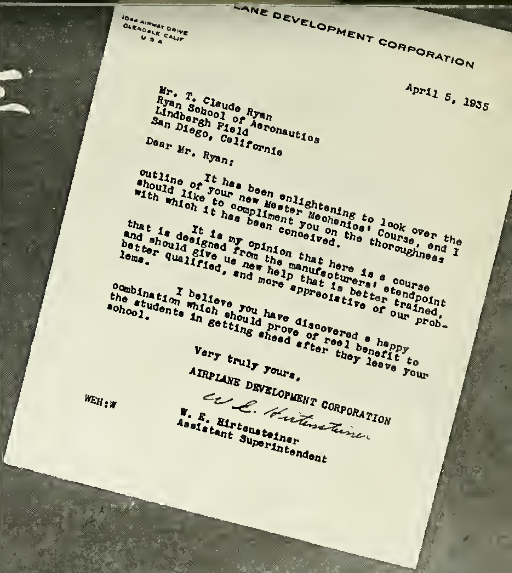

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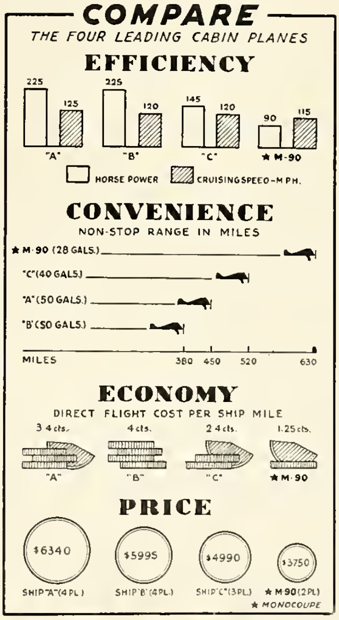

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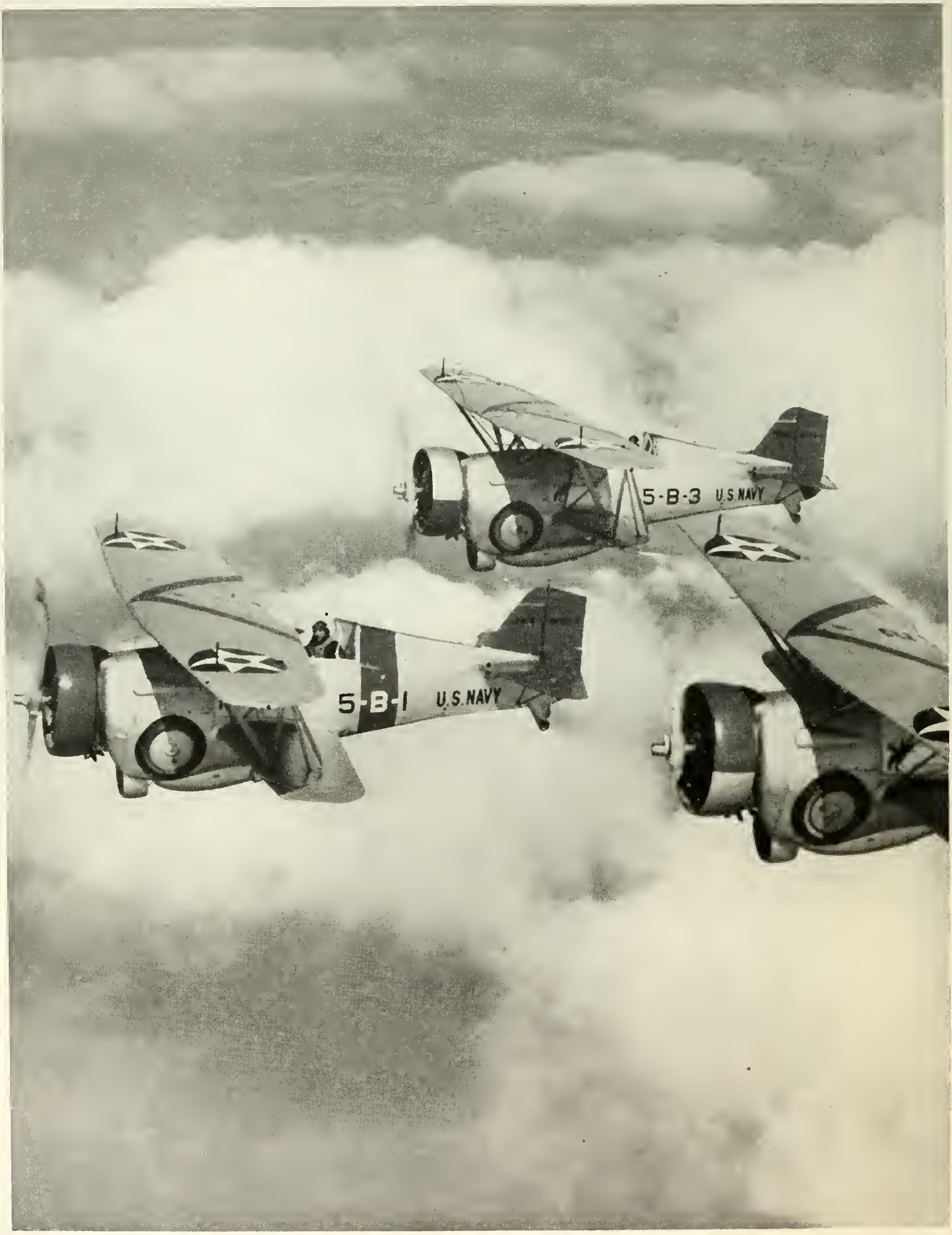


Sea Hawks of the United States Navy. VB-5B Squadron leaders of Curtiss BF2C-1 Hawks. These one place fighters, from the new aircraft carrier U. S. S. Ranger, are led by Lt. Commander J. D. Barner, U. S. N.

Air Power – The Mobile Attack Element

CY CALDWELL

● At last the world awakes to a partial realization of the growing menace of Air Power. Not the old naval and military leaders, but the people themselves and their political representatives, are beginning to realize that in the event of war their armies and their navies will be impotent to defend them against this threat of death and defeat from the skies. Hence at Geneva the League of Nations hums with activity as widespread defensive air alliances are being developed; an alarmed England hurriedly forms a department of Air Defense; citizens of Paris are buying gas masks and building gas-proof shelters; Germany is rushing to completion an Air Force to be the equal of any; and Russia, Italy and France are expanding their Air Forces to meet this new threat to their security.

But why this seemingly sudden alarm about the air menace? Why, when for nearly seventeen years military and naval aviation has been considered merely an auxiliary of the ground and sea forces, should the nations of the world now voice general fears and strive frantically for defensive measures? The answer is that there is nothing sudden about it; great masses move slowly: mass consciousness and mass opinion can coalesce into action only after the passage of time. That time now has passed; the lessons of the World War, and the technical development of aviation since the war, are becoming understood. Armies and navies are beginning to slip back into the position of purely defensive elements, and Air Power is forging ahead to take its menacing place as the one vital mobile element of attack. To comprehend clearly why this condition has arisen it is needful to study and to analyze recent history.

The first world war, 1914-1918, demonstrated that while the basic principles of war remain unchanged from century to century, the methods of waging war are in a continual state of mutation. This is due (as it always has been) not to any progressiveness in the minds of military leaders, but solely to the continuing impact of science, invention, and industry on the whole fabric of human society.

Prior to 1914, armies fought against armies, navies fought against navies; and victory went to that nation whose armed forces administered a crushing defeat to the armed forces of its opponent. This condition prevailed as late as the Spanish-American war in 1898 and the Russo-Japanese war, 1904-1905. In both of these minor conflicts the armies and navies of the contending nations engaged each other, but the warring nations themselves remained practically unaffected; civilian life, and also the countries' industries, carried on as usual, though slightly stimulated by the excitements and the physical necessities of war. The actual fighting was performed by professional or especially hired soldiers and sailors, a small minority of the total population of the warring nations; and while the combatant forces were strengthened by the recruitment of civilians by voluntary enlistment, the great mass of civilians remained merely interested spectators who paid for the military show, but who took no active part in it.

Static Warfare

The Spanish-American and the Russo-Japanese were the last of the old-style wars; 1914 saw the birth of the new, in which a large proportion of the adult civilian strength of the combatant nations must, of necessity, be enrolled—a procedure, incidentally, which was forecast by the American Civil war, 1861-1865, and which was entirely overlooked by the military leaders, most of whom are amiable individuals who normally devote more intensive thought to golf and polo and even bridge than they do to a study of their chosen profession.

This immense modern enrollment of civilian strength was not only in the fighting forces; it was also in the huge non-combatant forces recruited solely for war purposes; the vast army of industrial and agricultural workers without whose active support the numerically inferior fighting army soon must find itself unarmed, unfed, and helpless. Both of these forces, the non-combatant and the combatant, are *war forces;* and it is as impossible to dissociate the one from the other, as it is illogical to suggest that the one force may be attacked and the other force should not be attacked; that the one may be bombed and killed while the other should be spared to go about its equally vital war work. The one war force complements the other war force, working on two different war fronts—the *fighting* front and the *supporting* financial, industrial and agricultural front.

In 1914 the armies and navies of the combatants became merely weapons in the hands of the nations; for it was the *nations themselves* that were fighting with all of their resources, civilian and military. And as the war progressed, with neither side gaining any decisive advantage that could put a stop to the struggle, it gradually became clear that the armies and navies were employed, not simply as a fighting force, but as a means of wearing down the enemy.

It is perhaps difficult for the public to understand that armies played such a static part in the last struggle; for all recall reading almost daily accounts of offensives in the various theatres of war. The lines writhed back and forth, bending, but never breaking. It was as though the entire battle line were a gigantic whip which curled this way and that as the opposing generals cracked it; but for all the sound and fury it held. The German Western Front did not break and roll back until *after* the German nation cracked under the strain of starvation, shortage of materials, and the consequent breakdown of morale. And this effect was brought about, not by the Allied armies, but largely by the British Navy, which denied necessary supplies of food and war material to the Central Powers.

The war at sea also was of a static nature, a war of attrition, of wearing down. Despite the desire of the British Command to give battle, (because they had the superior force) they were unable to do so—except by mere chance, as at Jutland and Dogger Bank. The Germans, fearing to risk an engagement with that superior force, wisely—or timidly, if you like—retreated behind their mine fields; and at the end of the war their entire fleet, intact except for its losses at Jutland, was tamely surrendered. It had not been defeated, but with the breakdown of morale of the German nation, the crews of many ships had mutinied; the great fleet then was not a fighting force: it was merely a collection of ships manned by disobedient crews. Thus has been demonstrated the fact that a splendid and physically powerful aggregation of fighting ships may be rendered powerless, and forced to surrender without firing a shot. And this, of course, was brought about by the effectiveness of the blockade, maintained for four years by the Allied navies, which hemmed in the Central Powers, forcing them to use up their material for war, and denying them new resources.

The German submarines were not used as a fighting force, but as individual

The Richthofen Squadron, an example of Germany's new air power

commerce raiders. As the Allies blockaded the Central Powers with their navies, so also the German nation endeavored to blockade its enemies by the use of these under-water craft. This, too, was a war of attrition; and it became a critical question which group first should succeed in starving the other into submission. If, for instance, the German submarines had been able to deny to Great Britain all shipments of food and other supplies from the Colonies, from the United States, and from South America, England would have been forced to sue for peace, even though her army and navy had not been defeated.

Thus while armies and navies engaged in a modern large-scale war ostensibly act as agents of battle, to defeat or at least to wear down the opposing military forces, what they actually accomplish is *to destroy and use up the resources of the nations for which they fight.* Hence it follows logically that the loser in such a war may be defined as the contender whose war force, both combatant and non-combatant, *first completes the task of devouring and destroying the material resources of its own nation.*

Though defeat in modern warfare undoubtedly proves bitter, victory is but little sweeter. While the German forces were busily engaged in destroying the resources of the German nation, the Allied fighting forces were similarly employed eating up and wearing out and shooting away the material resources of the Allied nations. They "won the war" because they did not *quite* succeed in eating up their *own* nations before the Germans had succeeded in devouring theirs.

Nations have risen to positions of world importance, not by the material progress of peace, but by the martial progress of war, which alone rendered the peaceful progress possible. The British Empire has been built upon a foundation of innumerable wars; the United States became a nation, not by remaining a peaceful English colony, but by going to war and fighting for its independence. The colonies, in turn, were peacefully settled only after the pioneers had fought with the Indians. The bearing of arms is man's oldest profession, and even to this day it is considered a most honorable profession. It becomes unpopular only in peaceful intervals, when citizens are grudgingly paying for, or dodging payment for, the last war.

The Japanese still find war profitable. In less than thirty years they have fought their way from the geographical restrictions of a few small islands to the domination of an Eastern Empire. But so far the conquering Japanese have engaged only a Russia rotted by court abuses and a China torn asunder by internal strife. When Japan tries conclusions with first class powers, when not only her army and navy but also her entire national resources are employed, she will experience the same state of national prostration that victors and vanquished alike experienced after the first World War.

What new condition has been forced upon war to make it profitless to all concerned?

The answer is that war, now generally recognized to be of economic causation, at last has come under that economic law first stated in relation to agriculture, but which now holds good also in manufacturing, trading, and banking. It is known as the Law of Diminishing Returns; and the soldier must study political economy in order to understand how it now must apply to him and his ancient and honorable profession of wholesale slaughter and international starvation.

Stated briefly, Diminishing Returns is the law that, after a certain point of exploitation has been reached, the capital and labor applied to the cultivation of a piece of land, or to the production of any commodity in given conditions, yields a decreasing return. There is a maximum return for any given industry in any given area: a maximum return under *any* conditions for the expenditure of *any* human effort in *any* human undertaking.

The maximum returns for war undertakings occur when strong forces engage weak ones, and easily overpower them. The returns must diminish when forces of approximately equal magnitude are engaged; for the one ordinarily must lose as much as the other, so neither can gain. And the returns vanish, and loss occurs when, as in the first World War, the war forces, both combatant and non-combatant, become of necessity more costly than any possible return can be.

No nation can profit from future wars fought under similar conditions, unless a more effective and less costly method is devised to meet those conditions. Armies and navies have demonstrated clearly what they can do, and all that they can do, when they are employed by contending nations with equal or nearly equal resources.

Successfully to circumvent the new law of Vanished Military Returns, as I designate it, our war commanders must seek to change, not the principles of war, which are unchangeable, but the methods of waging war, which are changing continually, due, as I remarked in an opening paragraph, to the continuing impact of science, invention, and industry on the whole fabric of human society.

Unable to defeat an opposing army of equal strength, our war commanders now must bend their energies to the problem of *passing over* the enemy army and defeating the non-combatant war force of the enemy nation on the second war front. If they can defeat this non-combatant force, this vast aggregation of agricultural, industrial, and transportational workers, the combatant army, and the combatant navy, will be disarmed at its vital source of supply. This problem to me is so obvious that I am astounded that our military leaders have failed to devote any intensive study toward its solution, but continue to argue the war strength of their respective nations in terms of battleships and cruisers and men in armies, burrowing like moles in the fields of war. Such forces already have proved beyond the shadow of a doubt, that they can only hang on and hack away until the opponent has been starved into submission; and when at last they starve the enemy, their own nation also is famished!

There is one war force, and only one, which can be used to solve this problem of military and naval stalemate. It is the force of Air Power, which the armies and navies of the world are using today as an auxiliary arm of their services. Soon after the start of the next world war, when the contending armies shall have burrowed into the ground, when the contending navies shall have retreated behind their sheltering mines, the nations will awake to the fact that the only mobile combatant force that they possess is Air Power. Then there will be a mad scramble to produce, and to produce first, all of the physical elements that now are lacking. The nation that first achieves mastery of the air will be the victor.

AIR

Hot and Otherwise

Five Billion Dollars for Work Relief! How Much for Aviation?

FRANK A. TICHENOR

● The President has his five-billion—now what is he going to do with it? Is he going to use it—with the "sage" counsel of the Pursemaster General—to feather the nest of the Democratic party? Or is he, as he claims, going to apply it to really creative work?

If the President meant what he said in his latest soothing syrup chat over the radio, then he cannot fail to see that a fair share of this immense appropriation is employed in constructive aviation projects. The President stated he wants to spend the money on projects which are useful; projects in which the major expenditure will be for labor rather than materials; projects which can be allocated in relation to the number of persons on relief in various areas; and projects which will act to entice prosperity around that elusive corner. In aviation there is a job to be done which fits the bill in every particular—the creation of a nation-wide system of landing fields.

There is probably no other one thing the Government could do which would be so effective in putting men to work. By its very nature this project is one which would use men, not materials. For it is not airports, replete with hangars, lights, administration buildings and other less-useful-than-ornamental fixtures, that are needed. It is landing areas as such. And it takes men—not lumber and concrete and steel—to clear and level ground for landing areas.

There are few enterprises the Government could attempt which would be more useful or which would furnish a stronger foundation upon which to rebuild the national industrial house. Without landing places almost literally everywhere, the airplane—especially the private airplane—is deprived of most of its utility value. Hence without fields, the production of planes for private use is immeasurably retarded. Yet here in private flying the Government has a division of aviation that not only has almost limitless potentialities, but one which is ready to don seven-league boots the minute it is given half a chance.

The argument that we have too many airports already holds water no better than a fish net. True, there are only about three planes per airport in this country today. Yes, and there is probably only one bathtub per home in the United States. But at least that bathtub has the merit of being conveniently at hand when you need it. Which often is more than can be said of an airport. The airport problem is not a matter of the economic feasibility of commercial fields and whether or not they can pay their way. It is a matter of convenience and public necessity. No matter if there were a hundred times as many planes in the skies as there are, the commercial airport would still be unable to pay its way. It's the very nature of the critter to be economically contrary, because the most essential element of the airport, and the most expensive to construct and maintain—the landing area—produces not one cent of revenue. It must depend for its life blood upon the fixed base operators who line its borders.

Try to imagine how far the automotive industry would have gone if it had been faced with such an absurd situation, if the gas stations and garages along the highways had been expected to construct and maintain those highways. It would have gotten exactly nowhere, because the highways would never have been built and if America's great highway system hadn't been created, nobody except a few wealthy sportsmen would have had any incentive to buy and use motorcars.

This is no question of which comes first, the chicken or the egg. In every American pioneering venture in transportation, the facilities have come first and the users afterward. The railroads of the West were built before the prairies were peopled, but population was not far behind. The highways were constructed before there were hordes of drivers to ride on them. Why, then, with these precedents, should we in aviation try to reach our destination running in reverse gear?

The answer is that we should not and we cannot. The landing area (as distinct from the airport as a whole) is as definitely a public responsibility as the highway. And if this present Administration has the wits it brags of—this Administration which revels in sticking its finger in every private pie under the pretense that it has a public responsibility to supervise everybody's cooking—yes, if it has its wits about it and if it is sincere, it will recognize the landing area as a truly legitimate public responsibility through which a new nourishment can be injected into sick American business.

* * *

Thus far there is no evidence that it does recognize this responsibility. To be sure, off in an obscure corner in the crowd of projects the President has assembled to spend his paltry five billions on, you will find a timid mention that municipal loans may include airports. In most cases that will have just one meaning—when local politicians run out of other "useful" things to spend money on and harvest votes with, they will try their luck at pretending to build an airport.

If the Administration goes ahead along these lines, the airport part of the works-relief program will end up in a flatter spin than the CWA airport project did a year ago. There will be more wrecking than building. Airfields will be political orphans, nobody's baby, brats growing up where and how they can.

The inexcusable part about this prime example of aimless blind flying is that there are in the Administration's own family officials who have a fundamentally clear conception of how airfield projects ought to be handled. They know, and will admit, that nothing of value can be accomplished as long as the decision as to the allotment of funds for airports is in the hands of politicians and administrators who care nothing (and know even less) of what aviation is all about. They realize, and have urged their superiors to recognize, that airport projects in the works-relief program should be placed under a heading of their own; that they should be handled by a group of men who are really interested in them; and that they should be carried out with a vision of the future on a coordinated plan which, when the present temporary program has run its course, will furnish the basis for a permanent Government collaboration in the construction and maintenance of landing areas. But they are butting their heads against a stone wall.

Woe unto the rest of the works-relief venture if it is conducted in the same bungling, dunderhead fashion which it now appears will be the miserable fate of the airport part! It will take more than radio soothing syrup to explain that to the American taxpayer.

Aircraft in the Antarctic

LT. COMMANDER GEO. O. NOVILLE

Executive Officer and Fuel Engineer

●

The following account of aeronautical activities on Byrd's second Antarctic Expedition, written exclusively for AERO DIGEST, was sent by Mackay Radio before the expedition left Little America for the return to New York.

Tidewater Oil Co. photo

● When Admiral Richard E. Byrd and his crew arrived in the south polar regions early last year they had aboard their two ships the most complete aeronautical equipment ever taken to the Antarctic.

Since the aircraft activities of the Byrd Antarctic Expedition were most extensive and even more diversified, and because their program and projects called for the use of almost every type of plane, their equipment included monoplanes, biplanes and an autogiro. There were single-engined types; others were powered by two or more engines while all-metal, all-wood and a standard combination of both types, made available aircraft activity in a wide choice of flying equipment.

Upon arrival at the Bay of Whales, the expedition had five aircraft—a Curtiss-Wright Condor, a Pilgrim, Autogiro, Fairchild and a Ford. Three of these, the Condor, Pilgrim and Autogiro were brought in last year, and two were "on the ice"—relics of the previous expedition.

February, the month of arrival, allowed very few flying days. Bad weather and the winter night were close at hand so that thoughts and activities were concentrated on properly storing the planes to protect them from the rigors of the severe Antarctic climate.

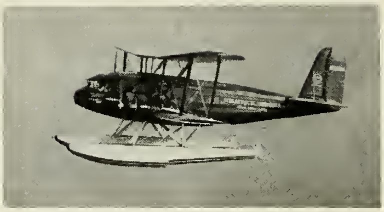
The hangaring problem, either in the Arctic or Antarctic is far from simple, but the difficulties can be, (and have been) overcome, mainly at the expense of sore backs and blistered and frostbitten hands and faces. To construct a hangar of standard merit would have required superhuman effort and considerably more time than was available. Tents were out of the question due to the force of the terrific winds, so it remained for the expedition's personnel to develop other methods to provide safe and accessible storage and housing facilities for their aircraft.

The solution of the problem at first appeared drastic, but nevertheless, it proved to be satisfactory in every way.

After considerable discussion on the slow trip down to the Antarctic, it was decided to construct a complete hangar of snow—somewhat of an airplane igloo with a partially-supported roof. Upon reoccupying Little America, work on the hangar began at once. A pit four feet deep and fifty feet square was dug out of the hard surface of the snow. Rectangular-shaped snow blocks were taken from the hole to build the side walls and placed in position so that the walls were high enough to clear the top of the wings. Fastening the blocks in place was unnecessary as they froze to each other as soon as they were in position, forming a continuous, solid structure.

The planes were towed into place after the side walls were up. The front and rear walls were then erected, allowing sufficient space around the wing and engine so that overhaul and inspection work could be accomplished without hindrance. Heavy bamboo poles, over which two tarpaulins were stretched, formed the roof.

While this work proceeded, the temperature varied from 40 to 63 degrees below zero. It was not only uncomfortable, but also dangerous to remain still very long and no one loafed on the job. A low-velocity wind would bring out white patches on the men's faces in a few minutes and then there would be much vigorous slapping and rubbing to restore circulation. Many of the men bore scars for a number of days after the work was completed. Hot coffee and cocoa was served at intervals and every two hours the men went into the huts to thaw out.



Harold June flying the Condor

On two occasions blizzards and blinding storms delayed the work of hangaring the Condor when it was almost ready for its closure. In both cases, when the storm abated, the plane had to be dug out from under the snow. The task finally was completed, and thirty days later the buildings were completely obliterated under a heavy blanket of snow. Through the long winter night the planes were snug; their engines were overhauled, additional necessary instruments were installed and many minor changes made.

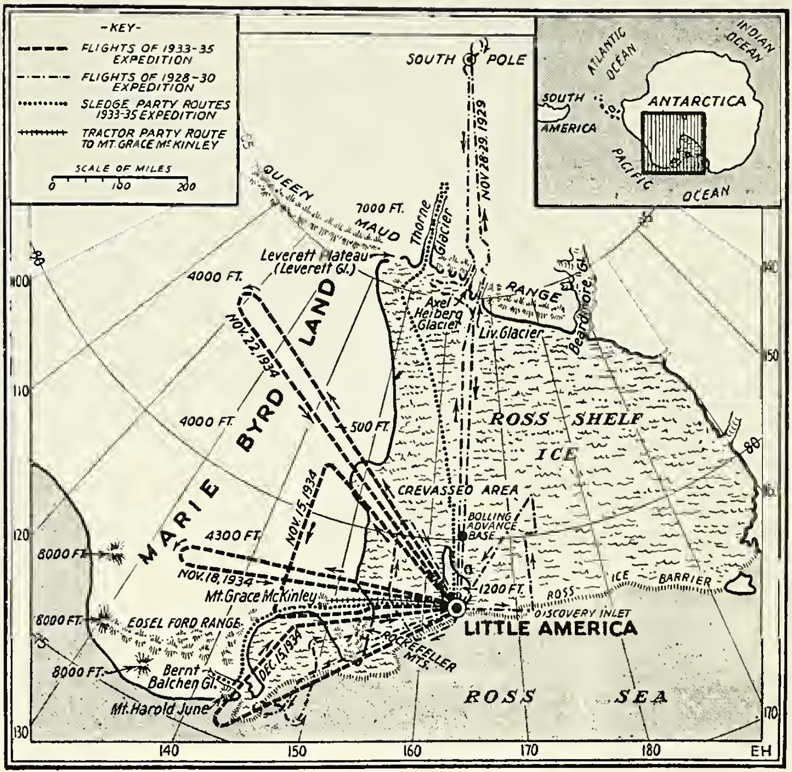
When the first glimmer of sun over the horizon signalized the end of the winter night, the expedition took to excavating the hangars. Fifty men at one time set to work on sheds housing the Condor, Pilgrim and Autogiro and soon progress was evident.

First, the snow had to be removed from the roofs, the walls torn down and a ramp constructed from the floor of the hangar to the surface. When this was finished, a tractor towed the planes out of the hangars to new locations on the surface where they were securely anchored.

Digging out the Ford and Fairchild, however, was much more difficult. These planes had been buried for five years under tons of snow, the Ford lying under a 12-foot layer which had turned to solid ice, and snow saws were required to dig it out. The wings and fuselage were cleared of a four-to six-inch sheathing of ice by the most careful and judicious use of hatchets and ice axes, an operation which required several days.

Shock absorbers on both planes were fully compressed, the entire weight of the ice and snow being taken by the wings, so that when the Ford was cleared, a tarpaulin was placed over the pit and secured until a thorough inspection could be made. The same procedure was followed in excavating the Fairchild, except that this plane was hauled to the surface and placed on the line with the other planes.

When the Fairchild was uncovered, it was discovered that the forward strut on each side of the wing had buckled under the snow's weight. The compression on the wings was so great that when the ice bonding was finally bro-



Maps by Harold June, Courtesy of New York Times

Map of flights made in the Antarctic by the Byrd Expeditions

ken, the wing sprung back into place with a reverberating sound.

The fuselages and tail surfaces, as well as the interiors of both planes were undamaged and the cabins still housed the fuel and oil left there five years before. Very little work would have been necessary to have either plane in the air again.

The ensuing aircraft activity of the second Byrd Antarctic Expedition is without parallel either in exploration or survey work. During a period of fourteen months the planes made 142 flights and flew a total of 12,900 miles. In that time more than 6,000 gallons of fuel and 500 gallons of lubricating oil were consumed flying in an area heretofore unsurveyed, and a great amount of it seen for the first time by man. In the face of tremendous obstacles, natural and physical, this work was carried on only by intensive effort and planning on the part of the commanding officer. As a result, allowing for a visibility of 75 miles each side of the line of flight, more than 100,000 miles of territory were explored. From the outset the expedition was faced by almost insurmountable difficulties, the weather compelling a change in plans to use a site near Mt. Grace McKinley as a flying field from which flights could be made to the east and southeast.

Flights made in the Southern Pacific in the vicinity of latitude 72 west and longitude 162.30 were made in the float-equipped Condor from an area which was aptly named "The Devils Graveyard." The surface of the sea in this vicinity was strewn with thousands of icebergs, all in motion and some of such size that they could be really classed as ice islands instead of bergs. A forced landing in this area would have been dangerous to the flying crew as well as to the crew of the ship attempting a rescue.

Just a couple of weeks previous to our arrival at the Bay of Whales another expedition had suffered disaster in attempting to put their plane ashore. With the Byrd Expedition it was not a question of one plane, but of several planes and a proportionate amount of equipment. The bay ice upon which it was expected to unload already showed cracks, and positive evidence of movement. Nevertheless, not a single item was lost. Planes were landed and assembled on this moving sheet of ice and flown to a safe haven at Little America, not only with their own equipment, but with hundreds of tons of expedition supplies. The plan of operation for the 1934 and '35 season, which commenced in November, was so wide in its scope and constituted so many flights that there was some doubt as to whether or not the scheduled flights could be carried out.

Admiral Byrd in his aerial exploration wisely overlapped the work of the expedition of 1929 so that the results obtained by this expedition are merely a continuation of the work and effort planned by him several years ago. The aerial surveys and mapping have turned out exceptionally well. Mountain ranges which

(*Continued on page 70*)

Sutton News Service photo

The Curtiss-Wright Condor on skis alongside of Byrd's flagship "Jacob Ruppert" at Little America

EDITORIALS

"The great danger from air is the possibility that at the beginning of a conflict one nation may deal a decisive blow to another nation and thus win the war. If an equally powerful air force is granted to each nation, the decisive blow will become so uncertain that it will disappear or will in any case be so risky that the others will hesitate to venture it."—STANLEY BALDWIN, British Lord Chancellor.

Build Up Our Air Corps Reserve

● Since aviation is destined to play a dominating part in any future wars, prompt attention should be given to building up the Air Corps Reserve. This reserve will constitute 75 per cent of the total flight personnel in any major conflict in which we may become involved.

Present indications show a decided about-face in Washington concerning the Air Corps Reserve and its problems. While the attitude in the Capital may be regarded as constructive, it is entirely too evident that the matter has yet to be carried to a satisfactory termination.

For the first time, the Air Corps Reserve was included in an appropriations measure; $308,000 was set aside for 1935, and $845,000 for 1936 to provide new planes. Also for the first time, a man of Major Bob Walsh's stature was appointed to the office of the Chief of Air Corps to look after personnel equipment and training. But, there still is much to be done before the Air Corps Reserve can ever hope to satisfactorily fill the tremendous assignment set aside for it in the War Plans.

The Reserve is made up of war trained pilots who have kept up their flying and interest in reserve activities; of graduates of the Air Corps Training Center not commissioned in the regular army; and of civilian pilots who have qualified for reserve pilot's ratings. A majority of the active war pilots are still excellent fliers and their actual experience would be most valuable in case of emergency. Again, most of this group have attained a grade which calls for a war-basis assignment as squadron or flight commander of a tactical unit. The recent graduates of the training centers are well qualified for first-line service on short notice if kept in training. Civilians, while they do not comprise a large group, are an important part of the picture, and should not be treated with the patronizingly tolerent attitude which the reservists have always known in peace time.

These men have been limited to an average of four hours per month and to 100 miles from their base on cross-country flights. They are trained in obsolete equipment on their own time, and at their own expense except for the annual 14-day period of active duty (for a limited number of officers only). They get little from their commission, except the satisfaction of patriotic duty well performed. While the regular Air Corps officers have a kindly feeling toward Reserves, their prime interest is in carrying out their own somewhat stinted program.

If the Air Corps Reserve is to do a real job; if the country expects the Reservists to supplement the Regular Air Corps with the help it will need, more substantial provisions for this branch of the service must be provided without delay.

In order that Air Corps Reservists find sufficient inducement to maintain their efficiency and interest in the Air Corps, they should be given: 1—from 100 to 120 hours, in order to carry out a training schedule similar to the Air Corps, and one which will keep them fit. 2—a limited pay allowance for weekly drill periods similar to the National Guard and Naval Air Reserves. 3—serviceable planes of the most modern type equipped for instrument flying. 4—hangars and other necessities for the safe keeping of equipment and personnel.

Consider The Trade-in Value

● While the approach of ideal flying weather is the harbinger of accelerated aircraft buying, some people are so anxious to get into the air that, unless caution is observed in purchasing, some costly experiences may occur.

The wise buyer investigates the manufacturer's background, he looks into his past record, and inquires into the reputation established by the airplane or its producer from past performances. Replacement parts are essential to the longevity of an airplane and should stand as stringent an investigation as the airplane and its engine before the purchase is completed. The utilization of standard and advertised products is some indication at least, that the purchaser stands a good chance of getting a fair and reasonable return on his initial cost when he sells or trades in his airplane.

The fly-by-night, and the promoter with his office in his hat must be watched and avoided in consummating aircraft sales. There are too many progressive manufacturers producing dependable craft to waste either time or money on crates that originate overnight and develop, like a nightmare, in the slick mind of the promoter.

Youthful Russians Trained en Masse

● Millions of young Russians, men and women, have been provided with an opportunity to become more familiar with aeronautics under an order issued by the Soviet government last month. This edict makes military and technical aviation training compulsory for the almost 5,000,000 young Communists between the ages of 16 and 24 belonging to the junior organization of the Communist party, and young working people not affiliated with the organization.

The training prescribed for 1935 includes at least one parachute jump from one of the towers especially erected for the purpose, not less than 30 hours' study of aircraft engines, training in marksmanship and, in some cases, aircraft and glider piloting.

It seems fantastic that Russia (regarded as being at least ten years behind the times because of the necessity of working out a new order of government) is the first country to foresee the desirability of training, in the art of aviation, the mass of its young people on whose shoulders the brunt of any military conflict will fall.

Russia is sufficiently farsighted to realize that the prime development upon which will fall the task of lifting backward nations into a place in the sun is aviation.

The official reasons for this order will perhaps never be known, but whatever they were, they probably will make Russia outstanding in the world of commercial and military aviation.

The strides this country made in the air were indicated in the April, 1934, issue of AERO DIGEST in an article entitled "Aviation Development in Soviet Russia." At that time, Russia led the world in the utilization of the airplane for industrial purposes such as cotton dusting, crop sowing, aerial surveys, and scientific investigations from the air. It requires no great stretch of the imagination to realize how much further advanced she will be in a few years.

Something must be woefully wrong with American aeronautical organizations when they allow this country to fall behind in a mass adoption of aviation; so wrong that Representative McSwain of the House Military Affairs Committee energetically condemned them when this article was brought to his attention.

Personairlities

By Caldwell

● IGOR SIKORSKY was born at Kiev, old Russia, May 25, 1889 educated at the Naval Academy in what was then Petrograd, and the Polytechnic Institute of Kiev. He graduated at the age of 19, full of information, enthusiasm, and yearning ambitions—only to bring his heel down firmly on an aeronautical banana skin called a helicopter, and even harsher names by frustrated designers and builders. For two years the inventive young Sikorsky read Russian novels and built this helicopter, being driven almost to desperation by these two frantic forms of art, until at last he proved to his own satisfaction that he had succeeded in building a standard helicopter—one that went neither up, along, nor anywhere else except into oblivion.

Once he got the deadly helicopter virus out of his system, Igor Sikorsky recovered rapidly and built an airplane, the S-1, powered with a powerless 15 h.p. Anzani engine. In this machine he taxied off and on during the year 1910, covering a large section of Russia as an early aviation tourist, and trying to get the S-1 into the air. The Sikorsky was willing, but the Anzani was not, so the discouraged builder finally trundled the ship back into his little factory, rebuilt and re-engined it, and on June 16, 1910, was ready for a test flight in that craft, named the S-2, thus setting another aviation precedent by changing the type name of an unsatisfactory production. As the poet (I don't know what poet, and don't care) remarked, "The lives of great men all remind us we can make *our* lives sublime; and, departing, leave behind us footprints on the sands of time." But watch your step and keep out of saloons and pool rooms.

In 1910 there were no Russian schools for flight instruction or airplane building, so Igor Sikorsky read what he could find on the subject but was baffled by lack of information, for at that time Tex Rankin had not yet become an author. So Mr. Sikorsky was forced to experiment with models and watch the flight of birds, coming to the conclusion that it was a good thing cows don't fly. Armed with results of this research Mr. Sikorsky took off and flew about 800 feet at an altitude of 2 or 3 feet. Six days later he crashed the ship, repaired it tried it again on July 12, and crashed it beyond repair on July 13, after a flight of 49 seconds in the air and two or three seconds on the ground while the ship was disassembling itself.

This would have discouraged the average man, but Igor Sikorsky is not an average man. He took this hard luck with all the stoic fortitude with which the Russian people ordinarily take their Russian literature, Russian art, the Moscow street cars, and the prevailing government. A Russian is used to tough luck, and grows to expect it. Ask him how he feels, and he'll tell you that he feels better today than he expects to feel tomorrow. Americans are always grouching about today but hoping to be happy tomorrow. You can't fool a Russian—he knows that things are probably getting worse all the time, so when by mistake something good happens to him he's pleasantly surprised. That's why all these Soviet young people go up by the thousands for parachute jumping—they're so happily amazed when, against their expectations, the parachute opens. If it didn't, the descending Russian would say to himself on the way down, "Well, I didn't really expect it to open."

Igor Sikorsky

The undaunted Sikorsky started another plane and had it completed by December, 1910. After a few successful flights in this ship, the S-3, engine trouble forced him down on a frozen lake, and his natural luck insured that the ice would break and that he would lose the ship. He merely tossed off a couple of vodkas, hummed the chorus of the Volga Boatmen, and got right to work on another ship, doing most of the work himself. His materials, except the engine, were of local origin. The construction of those early planes was of wood and fabric, held together by ordinary nails, screws, bolts, piano wire, and the determination of the builder. The ships were crude affairs but they flew, at least until the next landing.

Mr. Sikorsky turned out airplanes with all of the enthusiasm of a sturgeon manufacturing caviar; his sixth one received the highest award at the Moscow Aviation Exposition in 1911, and the first prize in the Military Competition at Petrograd. In 1913 he built two four-engined airplanes and received first and second prizes in the Russian Military Competition. That year he built a series of multi-engined planes, the last having a gross weight of 17,000 pounds. From 1914 to 1917 Igor built 73 large airplanes at the Russo-Baltic Car Works in Petrograd for the Russian Army, which by 1917 was earnestly and sensibly engaged in walking back from the German Eastern Front. I created a bit of a furor in the dear old Royal Flying Corps by commenting publicly upon that incident and by remarking that it was the first time that an Army had ever displayed any intelligence! and that if we were smart we'd walk back too, leaving the politicians, the bankers, and the munitions manufacturers to finish the war which they had started. There was some talk of shooting me as a destroyer of morale, but they finally decided that I was only joking. But I wasn't.

In March 1917, the Russians staged a revolution in which czardom was overthrown, and Mr. Sikorsky had it brought to his attention that inventive gentlemen who had built airplanes for the old government were not being handed bouquets of roses by the new regime. So Mr. Sikorsky departed from the land of his birth and the scene of his first success. It was somewhat like the peaceful American Revolution a couple of years ago, when the Democrats captured all the post-offices and government salaries and

(*Continued on page* 20)

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The Wright Cyclone has been constantly developed, over a period of 11 years, from 450 h. p. to the present rating of 780 h. p. More than 2,150 Wright (Series F) Cyclones, rated in excess of 700 h. p., have been sold for all types of commercial and military service.

Wright Cyclone-Powered TWA Douglas Airliner

Wright Cyclone-Powere Eastern Air Lines Curtiss-Wright Condor

Wright Cyclone-Powered American Airlines Vultee Transport

(*Continued from page* 17)

banished Czar Hoover to Palo Alto; both revolutions were ostensibly fought for the proletariat, the peasants of Russia and the ordinary citizens, or pheasants, of the United States. And the results in both countries are the same: two gangs of politicians have been thrown out, and two new gangs of politicians have horned in. The peasants and the pheasants are going along about as usual, perhaps a little more disgusted and disillusioned.

Anyhow, Mr. Sikorsky folded his tent like an Arab and silently stole away to less troubled climes, pausing a while in France to build aircraft for the French government. In 1919 he came to the United States, already crowded with poor Russian refugees running Russian restaurants, with a chap dressed like a Cossack standing outside the door. With no capital other than that supplied by other refugees, Igor Sikorsky hired a hangar on Roosevelt Field and built the S-29, which Roscoe Turner, another refugee from Missouri, flew around in the cigar and movie businesses. Of course, bad luck continued to pursue the Russian designer, and caught up with him in the person of one Fonck, who during the war had been distinguished by his aerial victories but who after the war was distinguished chiefly by his ornate flying raiment. For years M. Fonck was about to fly from New York to Paris in a Sikorsky, but each year we'd cable to France, "Lafayette, he's still here." He finally rolled the Sikorsky in a ball after the most peculiar attempt to take off yet observed. This hard luck merely helped Igor Sikorsky to feel at home in his new environment and spurred him on to new accomplishments.

It would be incorrect to say that success finally came his way, though it did, as everyone knows; but he went after it so persistently that it really got tired of dodging, and gave up. Sikorsky amphibians and flying boats have been sold to the U. S. Government, Pan American Airways, and numerous airlines and private owners—visual evidence of the tenacity and the amazing courage with which Igor Sikorsky adhered to his original purpose in the face of almost insurmountable difficulties and disappointments.

* * *

● VIRGIL SIMMONS probably knows as much about flying as any pilot in the business. He spent three years with the famous Boeing School of Aeronautics, Oakland, California, as Flying Instructor, and engaged in the development of pilots for United Airlines. That period of his career came between the first day of January, 1930, and continued to the last day of December, 1932. The last year of his service with the Boeing School he spent as Instructor in Instrument Flying, or Blind Flying as it is sometimes incorrectly called. During that time Master Pilots of the Boeing School and Co-pilots of the line were developed in the technique of Instrument Flying. All of which is positive proof that Virgil is a bit of an expert, and a very wise old bird indeed.

He was not always so. He was at one time a downy and trustful young bird, leaping into the air in anything that hung together. It was back in the days of my youth when I was testing Navy torpedo and bombing planes for my good friend Glenn L. Martin, now a leading social light of Baltimore, that I ran across Virgil Simmons. He dropped in from Detroit one day in 1924 with two helpless passengers and a Standard. The Standard arrived as something of a shock to one of my sensitive and cautious nature. It had about it a discouraged and drooping appearance, a sort of let-down condition. As it taxied disconsolately up to the gas pump—which I also manipulated in addition to my aerial duties—it flapped its wings mournfully and waved them sadly from side to side, like the flexible branches of a weeping willow.

Virgil Simmons

I had never seen an airplane act like that before, and thinking it must be some new method of gaining aerial flexibility, or something, I examined the craft with interest. It was a new one, but recently out of its war-time crate, its varnish glistening in the sunlight. The flexibility, I discovered, was due to the fact that all wires were so slack that the wings could be moved up or down or sideways at will. "This thing seems very loose," I remarked doubtfully. "Are you sure it's properly rigged?" Virgil climbed out and looked at me in surprise. "It must be," he replied. "It has just been set up and checked over by a young man who graduated only this week from a mechanic's correspondence school course—I saw his diploma."

Well, it seems that this mechanic lad must have skipped a chapter in his course, or else the school forgot to mail him that lesson—the one having to do with cotter pins and locking wire in turnbuckles. I don't know, but the fact remained that there wasn't one single cotter-pin or one strand of locking wire on that entire craft. Virgil and I went over the whole ship, his eyes sticking further and further out of his head as we proceeded. He began to perceive that Death had merely avoided him, and had ignored his invitation to collect that Standard, and crew.

"I don't object to your committing suicide," I said gently. "Life is a bit of a problem, and I don't blame anyone for throwing it away. But I'm not going to let you do it on this field; we have annoyance enough now, what with Milburn and Van Dusen and Bill Crenning and Mike Bauer and Benson—not to mention Glenn himself—and one thing or another, all of which and whom are a bit of a trial to an old test pilot, peacefully trying to survive." Well, the upshot was that Virgil and I proceeded to knit together the rapidly disintegrating Standard, while the two passengers, sensing from our talk the narrow escape they had enjoyed, leaped into a waiting taxi and departed. They never came back, and finally Virgil left himself, blaming me for losing him two passengers.

Virgil reminded me of this episode in a recent letter. He is now, after a checkered career, general manager of the Danube Cafe in San Francisco, and flying as usual, for pleasure now. He has over 4,500 hours to date, and blames me for most of them. Under the Chinese system, he says, I would be responsible for his upkeep, for I undoubtedly prevented him from inadvertently committing suicide back in 1924. In certain parts of China, you know, if you are silly enough to save anyone's life you are personally responsible for him from then on. If, for instance, you discover a gentleman trying to commit suicide, and stop him, he simply moves in on you and remarks, "All right, you prevented my ending it all. Now look after me; my life henceforth is your concern." If the Danube Cafe fails to support Virgil he will, under the Chinese system, be entitled to look to me for sustenance. I hope the Cafe is a glittering success, for a have trouble enough supporting myself and family.

Virgil was born Oct. 3, 1896, at Baton Rouge, La., and his aviation career started when he graduated from the U. S. Naval Officers' Engineering School, Massachusetts Institute of Technology, took flight training at the Naval Air Station, Pensacola, Florida, and served as Flight Instructor, with commission and flying rating, in the U. S. Naval Flying Corps during the late nightmare known as the First World War. Virgil had a bit of luck in the war—he missed the fighting, and emerged to fly Jennies, Standards, Canucks, and later on Lairds

(*Continued on page* 70)

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PROPELLER FORCES

And a Suggested Correction Factor for Use in Their Calculation

DR. MAX M. MUNK

● The most formidable single item tending to overstress an aerial propeller is its centrifugal force. Other things being equal, stresses set up by centrifugal force are proportional to the square of the circumferential velocity, and the tip velocity of propellers (the governing circumferential velocity) is so high that it almost approaches the velocity of sound. A pronounced tapering off of the blade cross-sections from root to tip is the generally adopted method for keeping centrifugal tension within proper limits, and the mechanism of the creation of this centrifugal tension is comparatively simple, and, on the whole, well understood.

Thrust Bending Moments

The stress items next in importance are the bending moments set up in the blade (acting as a cantilever beam) by the aerodynamic forces chiefly by the thrust, acting thereon. Since the propeller blades pull the airplane forward, they must themselves be pulled forward by the air so that they are subjected to a thrust bending moment which deflects the blade (chiefly its outward portion) forward into the direction of flight.

The old established method of propeller stress computation which has survived to date, combines centrifugal tension and thrust bending, and computes therefrom a composite pulling and bending stress distribution; the maximum of this stress distribution must be withstood by the propeller within an accepted margin of safety.

Initial Centrifugal Bending

This safety margin is necessary for taking care of the secondary stresses not taken into consideration in the above simplified stress computation. These secondary stresses are vibration and acceleration forces set up by the unevenness of the engine torque and other factors. Further secondary stresses are produced by the centrifugal force itself, as the resultant centrifugal force generally does not pass exactly through the center of each blade cross-section. For this reason (and others) the centrifugal tension is not constant and uniform through each blade cross-section, and its maximum is larger than its average.

Attempts have been made to so design the propeller that such unevenness of the centrifugal stress is helpful rather than detrimental. That principle is technically known as *relief by centrifugal force,* which, however, does not mean that the centrifugal force relieves the propeller stresses. If it were possible to eliminate centrifugal force entirely, the stresses of each propeller could be made smaller than they actually are. The relief in question is only relative. The uneven centrifugal tension distribution sought is not in itself an asset but is somewhat a slightly smaller liability than an even distribution would be. For that it is necessary that the propeller be given initial forward tilt, arranging the tips farther forward than the roots. The thrust then tends to bend the blades forward, just as it does in straight blades, but the centrifugal force tends to bend them backward in addition to stretching them radially. Hence, at least the two constituent bending effects may neutralize one another and the total stress distribution become more nearly even. This holds true only to a certain degree, for the thrust bending moments depend on the flight condition, and, unlike the centrifugal force, are variable even at the same r.p.m. There may even occur flight conditions where the centrifugal bending moment is unbalanced by aerodynamic forces, and its stresses greater than with radial blades. Any benefit of forward tilting is therefore not considerable.

Elastic Centrifugal Bending

Even without initial forward tilt of the blades this so-called "relief" unavoidably takes place. Because of their elastic flexibility, the blades are tilted forward in flight, and a corresponding "relieving" centrifugal moment of appreciable magnitude is set up. It has even been proposed to make this elastic centrifugal relief a governing design principle, and to so design the propeller that that relief becomes as large as possible, and dominate the shape; then the blades do not take any bending, but yield to it. In other words, the blades are made so flexible that they automatically assume the catenary or chain line of very small

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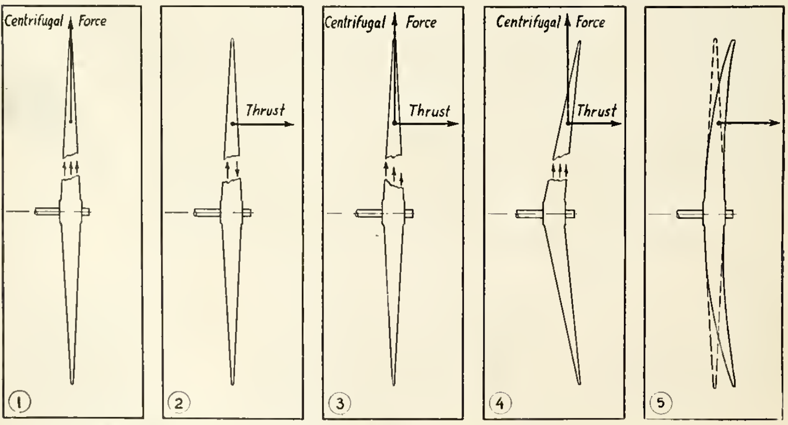

1—Centrifugal torsion. 2—Thrust bending. 3—Combined torsion and bending. 4—Relief by initial forward tilt. 5—Elastic forward tilt of initially radial blade.

Photograph by Cy Lotour

Vultee V–1A

. . holder of the transcontinental speed record for transport airplanes—equipped with Hamilton Standard Controllables.

HAMILTON STANDARD PROPELLER COMPANY
East Hartford Connecticut

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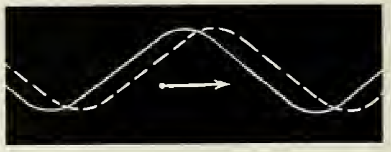
(*Continued from preceding page*)

bending moments, the thrust and centrifugal moments cancel one another at all points, and the resultant force passes through the center of the blade cross-section. The shape of the blade's center line is then variable during flight and depends on the forces set up. All bending stresses are eliminated and there only remains the direct, centrifugal tension.

This principle, unfortunately, has one difficulty which makes it impractical—if the blade is very flexible, not only its center strip, but each radial strip (whether center or margin) will be flexible, and each one, by itself, will tend to assume the catenary shape: an apparent "torsion" will occur, and will result in the diminishment of the pitch of the tip portion. The torsional rigidity of a conventional thin blade is not large enough to prevent this. Flexible for bending also means flexible for torsion. It is not possible to make the blade stiff with reference to its pitch, and at the same time flexible with reference to its bending, so that the creation of bending moments is prevented. The two conditions contradict each other. The effect that bends the blade into the shape of small bending moment is identically the effect that diminishes the pitch. The conditions would require making the blade at the same time flexible and not flexible. The secondary relief produced by centrifugal force in conjunction with elastic deflection of the blade is therefore of no practical importance.

Resonance Vibrations

After the introduction of metal propellers, it was found that propellers were destroyed not by the steady stresses just discussed, but by stresses set up periodically in connection with excessive vibrations. It became apparent that the propeller designer has to be as much on guard against excessive steady stresses as against the occurrence of resonance between the natural periods of the blade vibrations and the periods of unsteadiness of the engine torque. This unsteadiness arises from the variations of the individual piston pressures and is dependent on the r.p.m. in conjunction with the number of engine cylinders, or of the power strokes per revolution. The latter period is known, but the determination of the natural period of the proper vibration is a problem, for which, up to the present, no entirely satisfactory solution has been found. The problem is still acute, and is a live subject of study by propeller research engineers.

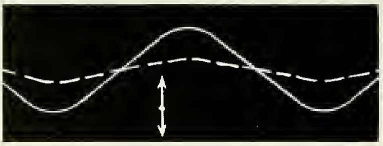


Advancing wave

The fundamental science of such vibrations is fairly well understood, but its application, the numerical computation of the critical periods for any individual propeller, is so involved because of the complicated shape of the propeller that it practically fails to yield a sufficiently accurate answer. The critical periods of a newly-designed propeller cannot be predicted at the desk, nor without recourse to tests specially conducted for the propeller shape in question. It is to such experimental methods, then, that we must proceed in our sketch on the subject.

Testing Rotating Propellers

The use of newly-designed propellers in actual service is not testing, but is the thing for which a substitute is desired. Any failure occurring in flight might be a final experience rather than a prediction or warning thereof.



Stationary wave

Propellers have been tested on the stand, mounted on their engine, to which by a pulsating oil pressure cylinder and piston device a proper torque variation with changeable period was supplied. This system of testing is more appropriate and avoids any dangerous conditions. In principle, however, it is hardly different from trying out the finished product and does not permit predicting characteristics beforehand. From the practical viewpoint, such testing by manufacturing organizations is difficult, expensive, time absorbing, and requires highly-specialized equipment and skill. It is the type of work suitable for special research institutes where time and money is not limited, and where it can be done in a few special cases.

As a variation, model tests with metal propeller models have been proposed. The model may be geometrically similar, or it may be merely affine, that is, reduced in a different scale in different directions, by leaving the diameter and blade chord unchanged, and by reducing the thickness and blade chord. Such a model would be expensive and its construction time absorbing. Model tests of this character do not, moreover, seem to give reliable results, and are chiefly proposed not for the original determination of the critical periods, but for correcting the values of the critical periods obtained by the experiments described in the following section.

Vibrating Stationary Propellers

An experimental method which has found favor in practice, (and which has some excellent points) has been evolved by the Bureau of Standards. Periodic impulses of varying periods are imparted to the non-rotating propeller by a non-rotating electric motor to which an alternating current of varying frequency is supplied. The test is not dangerous, can be made in a short time, and requires but a small horsepower supply. The propeller can be conveniently observed during the test, and the nodes of the critical vibrations located.

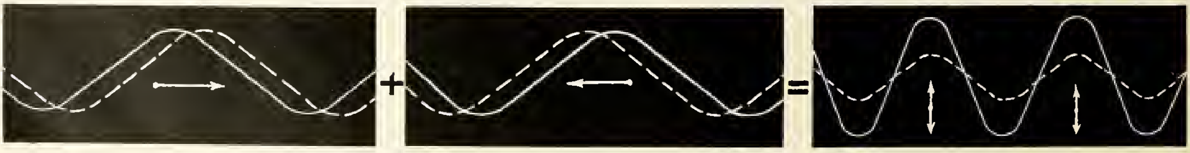
Apparently, however, the result is not accurate. Actual propeller vibrations in flight take place under the combined effect of the bending stiffness of the blade, giving (by itself) an oscillation comparable to that of a tuning fork, and of the deflection resistance of the blade stretched by the centrifugal force, giving (by itself) an oscillation comparable to that of a piano string. Both oscillations merge with one another and superpose, bringing about critical periods in flight which are higher than the corresponding periods arising from either cause by itself.

It is obvious that in the stationary test the centrifugal force and its effect are missing. Therefore the critical periods observed are too low. Efforts of investigators are now concentrated on obtaining an acceptable method for correcting the observed periods of stationary vibrations for the effect of the centrifugal force.

Correcting Stationary Periods

No practical computation method has been proposed by which the stationary periods may be corrected for the centri-

(*Continued on following page*)



Left advancing wave + right advancing wave = stationary wave

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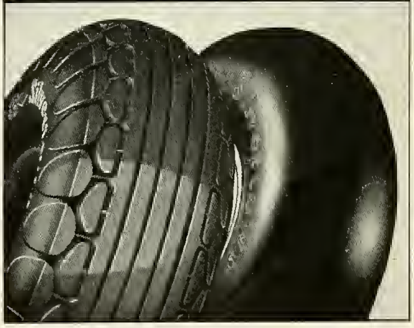

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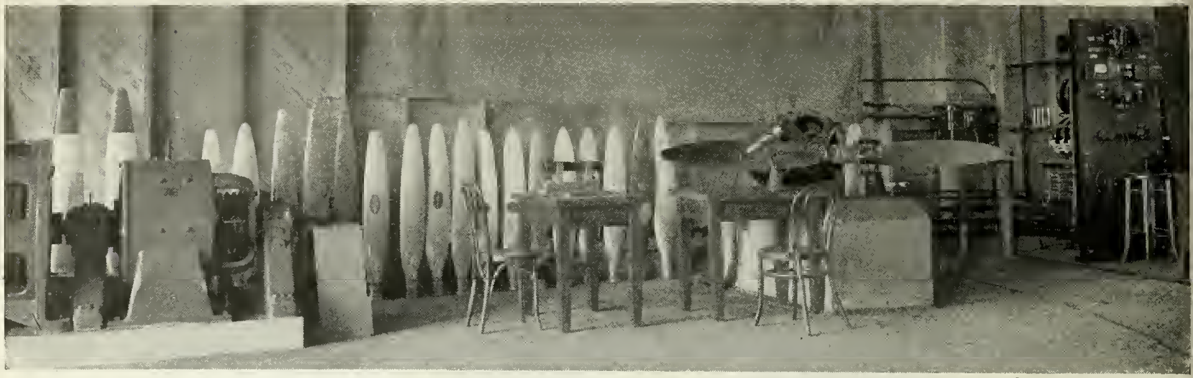

Bureau of Standards' electrical equipment for locating critical vibrations in propeller blades

(*Continued from preceding page*)

fugal effects, as far as this writer knows. We know that the centrifugal forces increase these periods, but we do not know to what extent. The best we can say is that the bending, and not the centrifugal, tension governs the vibration; that is, the bending is a primary and the deflection under tension a secondary factor for the period.

A correction method of moderate exactness would be valuable, the computed correction being a fraction of the final period, and the entire region of the critical period (not only the period itself) has to be avoided. Under these circumstances, it would seem that even an approximate formula, as long as it is sound and gives the order of magnitude correctly, would meet a real demand. The writer wishes to suggest a way of obtaining such a formula, presenting it only in skeleton form and submitting it to those who have data and experiments at their finger tips and are specially prepared and qualified for reducing it to practice.

The Proposed Skeleton Formula

A correction of stationary periods for centrifugal force can be obtained by considering the wave velocities of the vibrations. In physics, stationary waves are often interpreted to best advantage as a superposition of advancing waves, namely, of a pair of advancing waves traveling in opposite directions.

The velocity of advancing string waves depends on the tension stress and the density of the material only, and is: $u = \sqrt{\text{stress/mass density}}$, where u is the velocity of advancing string waves.

The velocity of bending waves depends on more variables, and particularly on the wave shape, and is, therefore, difficult to compute. In the present case it can be determined experimentally, or at least estimated from the test with the Bureau of Standards vibration machine, the wave length and the period being observed. More flexible blade portions will naturally have a smaller bending wave velocity than stiffer blade portions; but then again a shorter wave length (a shorter distance between adjacent nodes) gives rise to larger wave velocities. With the increase of the number of nodes, (with higher critical periods) the last complete stationary wave is compressed within a shorter (but also thinner) blade portion, and these two effects may partially cancel one another. It is possible that the bending velocity in the tip portion for one propeller does not vary much from one period to the other.

The third basic fact used is the relation between lateral acceleration and the velocity of the wave. An elementary consideration shows that the former is proportional to the square of the latter. From this it follows that the wave velocities superposing (as far as they superpose at all) add up in such a manner that the square of the resulting velocity is equal to the sum of the squares of the constituent velocities. The squares of the wave velocities (not the wave velocities) are added.

Since the string wave velocity (u) is proportional to the square root of the tension, and the latter is proportional to the square of the r.p.m., the velocity is directly proportional to the r.p.m. and hence its square is proportional to the square of the r.p.m. The bending wave velocity is denoted by v; the wave length for bending by L', and that for the composite, L''.

Since the period is proportional to the velocity, and inverse to the wave length a correction factor k results in which $K = L'/L'' \sqrt{1 + (u/v)^2}$. The first term (the wave length ratio) is unknown. It is likely that it varies much less, and more uniformly, than the entire expression, and research should concentrate its study on this variation. For the present, it is proposed to neglect this factor altogether, putting it equal to 1, thus first attributing the change of the period to the change of the wave velocity, and second to the change of the wave length itself. There remains, then, the simple correction factor

$$K = \sqrt{1 + (u/v)^2}.$$

It may solve the problem.

Aeronautical Patents

●

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Airplane discharging apparatus. John H. Guffey, Pittsburgh, Pa. (1,993,341)

Aerial signal device. Roland B. Respess, Wickford, R. I., assignor to Respess Aeronautical Engineering Corp., Cranston, R. I. (1,993,414)

Aircraft. Edward A. Stalker, Ann Arbor, Mich. (1,993,419)

Automatic steering systems for dirigible craft. Bradford B. Holmes, Stonington, Conn. (1,993,549, 1,993,550, and 1,993,551)

Aircraft. Harold T. Avery, Oakland, Calif., assignor to Autogiro Co. (1,993,701)

Supercharger. John O. Heinze, Detroit, Mich., assignor to Heinze Development Co. (1,993,963)

Auxiliary airplane propeller. Jose Fernandez, Newark, N. J. (1,994,018)

Airplane. Henry W. Nelson, New York, N. Y. (1,994,045)

Propeller pitch adjusting mechanism. Charles H. Martens, Bryan, Ohio. (1,994,143)

Aircraft with rotatively-mounted sustaining-wings, and autorotative wing craft. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (1,994,465 and 1,996,750)

Direct lift aircraft, and lift-increasing apparatus. Igor I. Sikorsky, Nichols, Conn., assignor to Sikorsky Aircraft Corp. (1,994,488 and 1,995,905)

Lighting airways. William A. Roth, St. Paul, Minn. (1,994,535)

Airplane. Meyer Persten, Brooklyn, N. Y. (1,994,663)

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Engine	Horse-power	Ignition	Top Speed	Cruising Speed	Landing Speed	Price
Continental	210	Magneto	140	122	50	$5,225.00
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The Mark VII Navigational Computer for Aircraft

P. V. H. WEEMS

Lt. Commander, U. S. N. (Retired)

●

● The Aircraft Navigational Computer was designed by Lt. Philip Dalton, Naval Reserve, for the Bureau of Aeronautics, U. S. Navy Department, as one of a series of dead reckoning devices, one of the first of which was the Dead Reckoner, or "VC-O," developed by the writer.

The long list of items designed to meet the practical needs of the pilot might confuse the beginner, but need not give him serious concern, for several of these developments have features in common, while only those which "click" go into production.

The Mark VII Computer is used by airline pilots as well as by military flyers, being of pocket size, and handy to use. It incorporates features which provide solutions to eight important dead reckoning problems, including conversions between compass, magnetic and true bearings; solution of wind star problems; solution of interception problems; speed-time-distance computations; airspeed indicator corrections; altimeter corrections; conversions between nautical and statute miles; and off-course corrections.

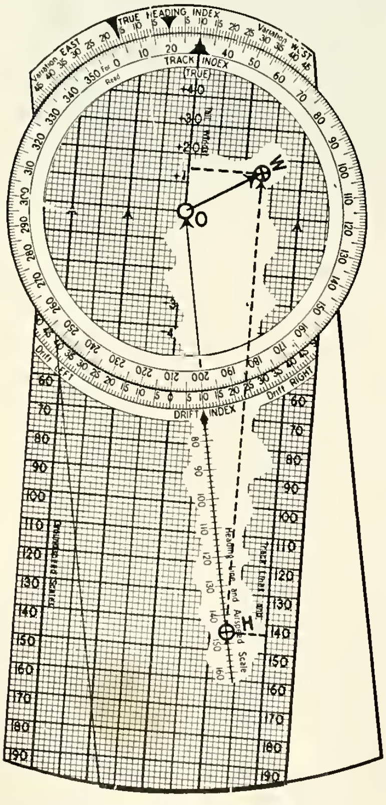


Fig. 1. Mark VII Computer showing grid piece and compass rose

While the speed-time-distance, course conversion and wind-drift problems are those which most often confront the average air navigator, the Computer also includes scales for correcting altitude and air speed for temperature and pressure. The average navigator often fails to realize the handicap of not having before him the correct air speed and altitude.

The Computer (figure 1 and figure 2) consists of a 4" × 11" white celluloid base plate over which is placed a transparent grid with a transparent 5" disc showing above the grid piece, and a white celluloid disc on the back of the base plate. All four parts are pivoted.

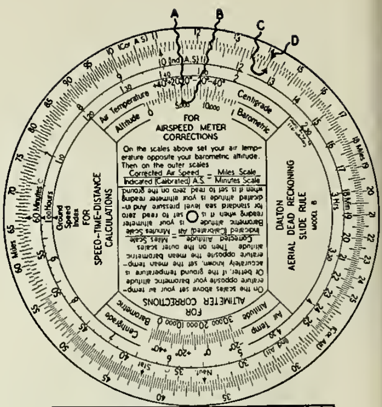
The transparent disc and grid are used to solve wind drift, off-course corrections, and course problems. The opaque disc includes scales for correcting the indicated altitude and air speed, and a circular slide rule for working speed-time-distance and other problems involving multiplications and divisions.

Sample Problems Illustrate Use

Two sample problems will be solved to illustrate the use of the device:

To find the resultant tract and groundspeed for a new heading or new airspeed, when given a 30 m.p.h. wind from 270°, a 4° mag. heading, variation of 16° E, and a true airspeed of 146 m.p.h.:

Set the track index at 270° and plot the wind arrow (*O-W*) from the centre of the plotting disc downward to the 30 m.p.h. mark on the headwind scale, and pencil-mark *H*, (figure 1) at the 146 m.p.h. mark on the airspeed scale. Then set 4° at the pencil-marked magnetic heading index and hold it at this setting by clamping one edge of the plotting disc to the base piece between the thumb and forefinger while the grid lines are adjusted parallel to (*H-W*). Then hold the three pieces together to read the track bearing (30) at the track index and the groundspeed (144 + 15) from the grid scales.


A
B
C
D
FOR AIRSPEED METER CORRECTIONS
FOR ALTIMETER CORRECTIONS
Air Temperature
Altitude
Centigrade
Barometric
SPEED-TIME-DISTANCE CALCULATIONS
DALTON AERIAL DEAD RECKONING SLIDE RULE
Miles
Minutes
Naut.
Stat.

Airspeed Meter Calibration						Date: 7/8/34	
For:	60	70	80	90	100	110	120
Read:	56	67	77	88	99	109	120
130	140	150	160	170	180	190	200
131	141	152	163				

Fig. 2. The slide rule, air speed correction, and altitude correction features of the Mark VII Computer

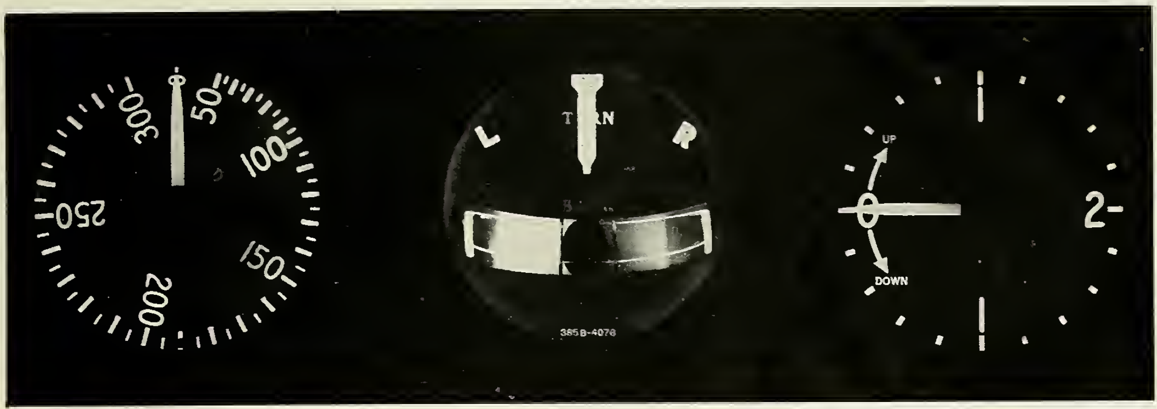
Corrections for Altitude

To obtain true airspeed a calibrated air speed must be further corrected for variations from standard sea level pressure and temperature. At high altitudes and in hot weather the airspeed indicator underreads because the air which operates it is less dense. As illustrated in figure 2, this air density correction is obtained by first setting the air temperature "A" opposite the barometric altitude "B" on the scales labeled *For Airspeed Meter Corrections,* and then reading the corrected airspeed "D" from the *Miles* scale opposite the calibrated airspeed "C" on the *Minutes* scale.

Given an indicated airspeed of 128 m.p.h. (airspeed indicator calibrations as shown at bottom of figure 1), and air temperature of 10°C, and a barometric altitude of 6000 ft., the true airspeed can be found as follows: from the calibration card shown at the bottom of figure 2, find calibrated airspeed, 127 m.p.h. equivalent to the given reading 128 m.p.h. As shown at "A" and "B" in figure 1, set the air temperature 10°C, opposite barometric altitude 6000 ft. Then opposite the calibrated airspeed 127 m.p.h. at "C" on the *Minutes* scale read the corrected (true) air speed 141 m.p.h. at "D" on the *Miles* scale. This gives a true airspeed of 141 m.p.h.

In a similar way the altitude is corrected for air density by the altimeter correction scale shown in figure 2. Extreme cases of inverted temperature with high temperatures at high altitudes, correction to indicated airspeed and altitude of the order of 10% to 30% result.

PIONEER *Ring Light*



Actual unretouched photo of Pioneer Ring Light

Soft, Uniform Illumination without Glare

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change in the instrument c

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Aerodynamical Research and Tests of The Fairchild High Speed Amphibion

ALFRED A. GASSNER

Chief Engineer, Military and Transport Div., Fairchild Aircraft Corp.

● In the Fall of 1933 Pan American Airways, Inc., prepared specifications for bids on a new type high speed amphibion plane which was to have a single 650 h.p. air-cooled engine, a capacity of 8 passengers, 2 pilots and 1000 pounds of mail and express, and a range at cruising speed of 750 miles. From the severe performance, maintenance, space and load requirements, it was obvious that only thoughtful employment of the published results of research conducted by aerodynamical laboratories, the use of new design features and extensive additional laboratory research on these new features could bring the desired results.

The economic complications of past years demand, more than ever, successful developments of new products without taking unjustified chances. This is especially true of the airplane industry where the ratio of gross production sales value to development expenditures is small, if compared, for instance, with the figures of the automobile industry. This is also one of the reasons why systematic research and calculations now replace the trial and error methods used during the earlier period of airplane design. However, we still need imagination for the start of a new research program, and probably more of it during the laboratory tests, in order to find solutions to over-

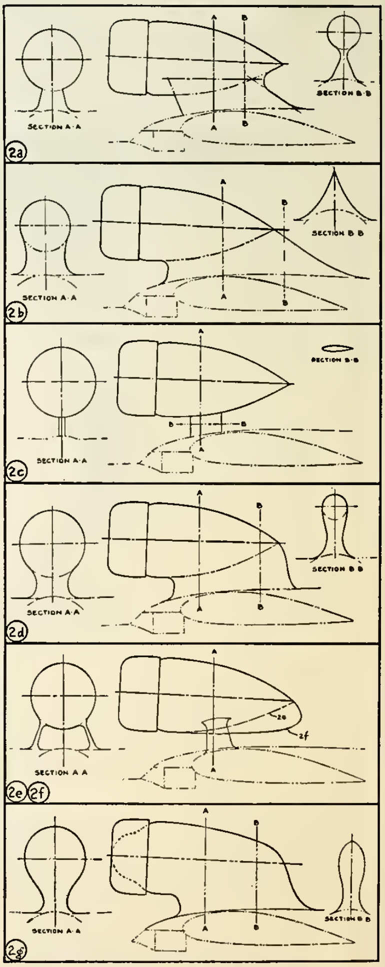


Figure 2: Engine nacelles tested

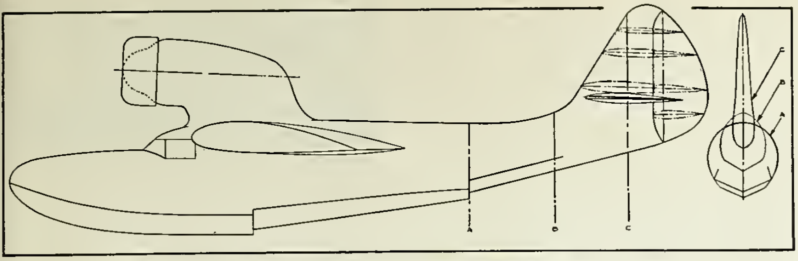
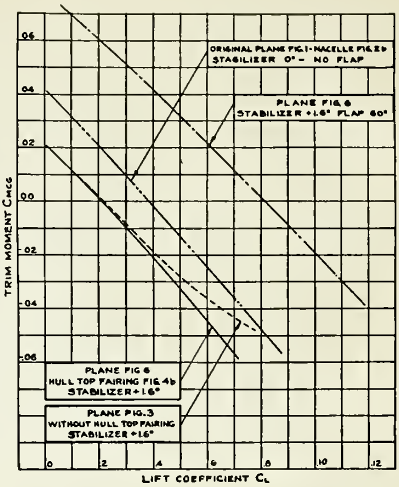


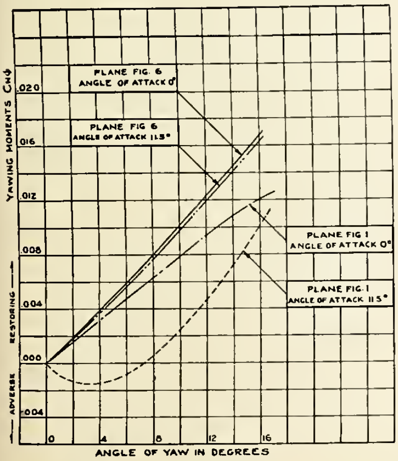
Figure 3: Modified vertical tail surface and rear part of hull



Graph 3: Longitudinal static stability tests with and without flaps

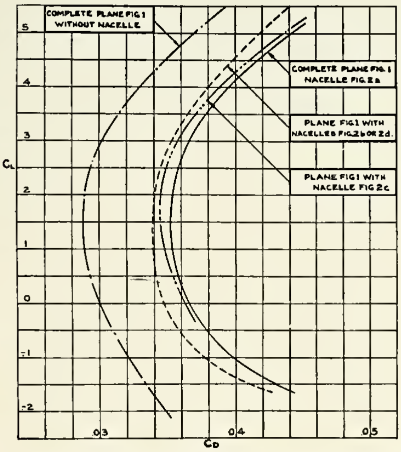
come the deficiencies which may be disclosed.

The first layout of the airplane is shown in figure 1. It contains all of the new principal features which have been maintained in the final design, although some have undergone modifications. The overall dimensions and the areas were chosen as small as possible within the given limitations. To obtain an aerodynamically efficient plane, it was designed as a cantilever monoplane with tapered wing, the maximum root thickness of which is 18%. The engine nacelle, arranged as closely to the hull as possible with a given propeller diameter, is of the tractor type and equipped with NACA cowling. The hull is designed with ideal streamlining in its plan view; all hull sections above the water planing surfaces are well rounded, and the wing is filleted into and set on the hull as low as possible to approximate a mid-wing arrangement. The wing tip floats are retractable against the underside of the wing. The landing gear is so designed that wheels and shock absorbing struts fold flush into the underside of the wing when in flight or on water. The latter design was chosen to obtain a wider wheel tread than possible with wheels folding into the hull and in order that the hull be kept small and yet as roomy as possible for cockpit and cabin space.



Graph 2: Stability in yaw; complete plane without landing gear, tip floats retracted

A number of NACA reports were available dealing with fuselage and engine, wing and engine combinations and their aerodynamic and propulsive efficiency. None of the published data, however, came close enough to the chosen arrangement. It was realized that the efficiency of the power plant arrangement would have considerable influence on the performance of the plane.



Graph 1: Nacelle tests without landing gear, tip floats retracted

Wind tunnel tests were carried out at New York University under supervision of the author, assisted by Professor Alexander Klemin and his staff. Initial results showed that the total drag was but slightly higher than anticipated in the preliminary assumptions.

The first tests showed that the drag of nacelle with NACA cowl and with the single support (figure 2a) gave a drag of nacelle and interference of 17.15% of the total drag of the plane at cruising speed. Modifications of the nacelle-to-hull fairing were tested next and are shown in figures 2b to 2g.

It appeared that the thick section fairing between the nacelle and hull top, with expanding fillets toward the rear, had less drag than the original nacelle arrangement and even less than the nacelle mounted on a single thin streamline strut. It must be assumed, therefore, that a large percentage of the drag of the nacelle arrangement is made up by interference drag. The air passing between underside of the nacelle and top of hull has to expand after it passes the narrowest gap. This expansion, which means a slowing down of the flow, costs energy. A further detrimental effect of the expansion is the fact that the air while expanding, overshoots the appropriate measure of speed, tends to move slower than required by the respective cross-sectional areas, and has to speed-up further aft of the nacelle so that the pressures blend. This instability of flow creates turbulence and vortices which are carried over the rear part of the hull and possibly over the tail surfaces, where they are liable to cause serious disturbances and vibrations.

The development of nacelle fairing

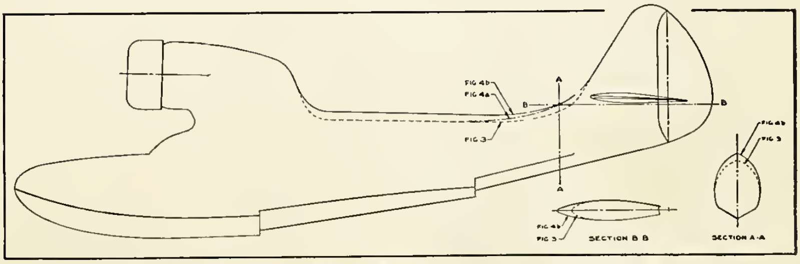


Figure 4: Two further modifications of the rear lines of hull

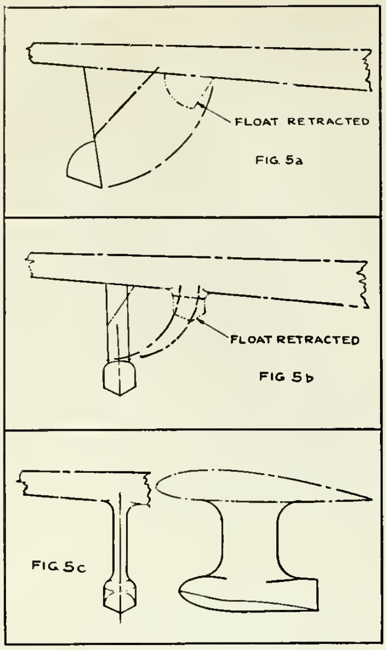


Figure 5: Types of wing tip floats

was, therefore, directed entirely towards retarding the air expansion, in a manner similar to that used on filleting-in of low-wing and fuselage combinations. Since the smaller (and, therefore, lighter) fairing of figure 2d gave the same drag as the large fairing of figure 2b, the final nacelle design was made in approximation of the former. Its improvements are that the radii of fillets at the lower rear part are larger, and that the top contour of the rear fairing is not carried to the thrust line, but produces a sort of vertical fin contour. Values of drag of various nacelle arrangements are shown in Graph 1 illustrated on preceding page.

Wind tunnel tests for longitudinal static stability showed satisfactory results. The original arrangement of the vertical tail surfaces gave fair directional stability values for low angles of attack. For high angles of attack the stability in yaw was, however, deficient. Test of the plane without vertical tail surfaces showed the same characteristics of yaw stability for high and low angles of attack. It was reasoned, therefore, that the shape of the original hull tail end and of the arrangement of fin (figure 1) caused a shadowing of the lower part of the fin at high angles of attack. A modified vertical tail and rear part of hull was designed (figure 3), with the fin growing organically out of the hull. The fin area was increased slightly to improve directional stability at low angles of attack. Wind tunnel tests showed that the desired improvement was obtained and that the stability in yaw was approximately the same for all angles of attack of the wing. This is illustrated by Graph 2.

Hull Deflected Air Upwards

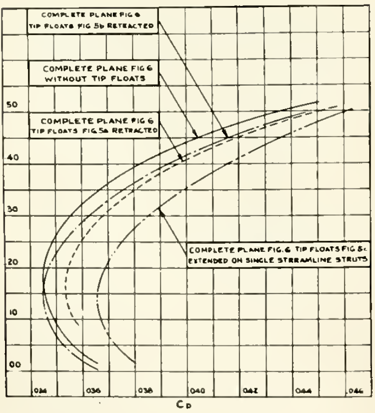
After the hull tail end and fin shape had been changed from that of figure 1 to figure 3, the longitudinal static stability was lower than in the preliminary tests. This was puzzling since the area and shape of wing and horizontal tail surfaces as well as the distance of horizontal tail from wing had remained the same. The only cause, therefore, could be a change of the airflow around the new tail, created by the change of the hull shape. Since static longitudinal stability depends to a large measure on the angle of down-wash, it was assumed that the new hull shape (figure 3) had deflected the air upwards toward the stabilizer. To prove this contention the hull shape was changed as shown in figure 4. While the original shape of figure 3 had had longitudinal horizontal sections which were rounded at their forward end, the hull tail end of figure 4a had sharper and more pointed sections; the up-sweep of the hull top-side contour was less abrupt, also. Tests showed a marked improvement in longitudinal static stability, the slope of the trim moment curve being much steeper, with trim angle practically unchanged. At the same time a reduction of the drag of the complete model could be measured. It seems that the air flowing into the space behind the wing and nacelle on model of figure 3 had expanded more than necessary and had to be speeded up when it met the uprising hull rear part and fin. If this was the case, a further elevating of the entire hull top contour as shown in figure 4c should have reduced the drag still more. This occurred during the next tests.

Completed amphibion ready for flight

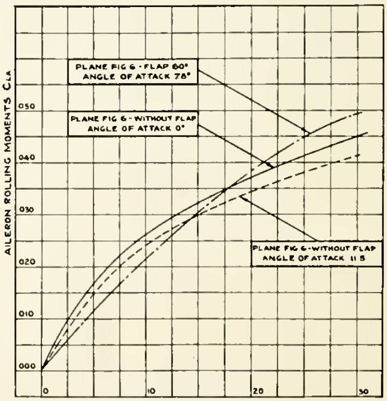
Results of tests for longitudinal stability are shown in Graph 3 for the plane with and without flaps. With a stabilizer setting of +1.6°, the plane without flap would trim at a lift coefficient of $C_L = .21$, or a level flight speed of 182 miles per hour. When flaps are lowered to 60° the plane trims at $C_L = .81$, or at a level flight speed of 98 miles per hour. The effect, therefore, is that lowering of the flap changes the speed of the plane without necessity of changing the trim—that is, without any operation of elevator or elevator tabs.

Wing Tip Float Design

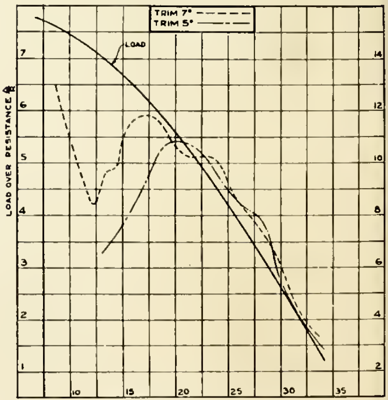
The development of the wing tip float design is shown in figure 5. The original design of the retractable floats as shown in figure 5a was discarded because of hydrodynamical reasons and also because of the higher drag when compared with floats in figure 5b. It was feared that the flat side area of this type of float might give difficulties in side landings on water and during taxiing. The design in figure



Graph 4: Development of tip floats



Graph 5: Aileron tests



Graph 6: Float basin test

Side view of wind tunnel model

5b involves more structural and mechanical complications, but it is of the conventional type when lowered for water landings. The lower drag of float 5b compared to 5a when retracted against the wing underside can probably be explained by the fact that this float is narrower and higher, and influences aerodynamically a smaller portion of the wing; it also has a higher fineness ratio and a shape which allows the air to flow around both sides of the float. The longest path which any air particle has to travel is shorter for float 5a, and the disturbance of flow and change of air velocity is reduced. This float was also tested when mounted on a single streamline strut, which was kept small on the wind tunnel model to exclude as much as possible scale effect disturbances. The superiority of retractable floats is indicated on Graph 4.

Wind Tunnel Tests on Ailerons

The plane is equipped with flaps of the Zap-type in which the flap leading edge slides backward along the wing underside while the flap is being lowered, a type which is most efficient for its weight and structural complications. The flap is tapered, its chord is approximately 25% of the wing chord throughout, and it extends over about 60% of the wing span from the hull to inner edge of the ailerons.

Further wind tunnel tests were made on ailerons without, and in combination with, the deflected flap. The ailerons are balanced, with differential action, which gives 15° down movement and 35° up movement. Results of aileron tests are shown on Graph 5. It can be noted that the ailerons with flaps deflected 60° are as powerful as without flaps.

In Aero Digest for December, 1934, Professor Klemin described a method of estimating the performance of an airplane from wind tunnel tests. The procedure described in that paper was used during the tests on the Fairchild Amphibion. The model was tested for VL or scale effects, by running the wind tunnel at varying speeds with the model maintained at the same attitude of minimum drag. By plotting the minimum drag against the airspeed an equation $D = K (LV)^n$ where K is an experimental constant and n is determined from the slope of the drag curve. The values of drag at zero lift for varying airspeeds are given in Table I.

The exponent n is established from the plot to be 1.91.

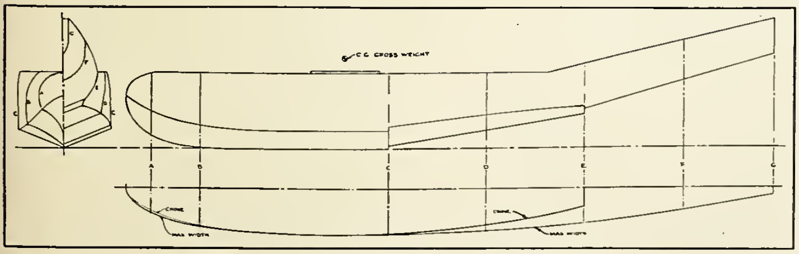


Figure 7: Lines of hull tested with second step (Model scale 1/8)

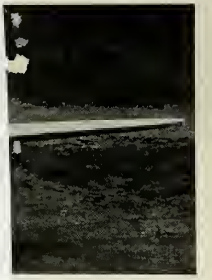
Table I

(LV) Test at varying velocities
Unfaired values from data
Angle of Attack—4°

Velocity m.p.h.	Drag (lbs.) measured	Drag (lbs.)* calculated
40	0.295	....
50	0.420	....
59.3	0.580	0.580
70	0.810	0.80819
80	1.065	1.05560
90	1.280	1.33599

* Calculated by V^2 method from drag at 59.3 m.p.h.

When the design of this plane was begun, no published information on float basin tests of hulls existed. A series of tests on four types of hulls was carried out in the new NACA float basin, under the direction of Mr. Starr Truscott and his assistants, and the hull type shown in figure 7 was finally selected. Tests were carried out with two types of hull with the rear part aft of the main step, one of which had a pointed, and the other a wide second step. Float basin test results as shown on Graph 6 indicate but slight differences between the two shapes of second step, and since the wide step gives a more advantageous arrangement for cabin space it was chosen for the final design shown in figure 6 above.



ican Airways

a flying boat with retractable landing gear, tail wheel and wing-tip floats. Power can be supplied either by a 670 h.p. Wright Cyclone or a Pratt and Whitney Hornet S4D1 engine delivering 650 h.p. at 3000 ft., but the first ship off the line is powered by the latter.

Hull

Although the Fairchild amphibion follows standard constructional methods

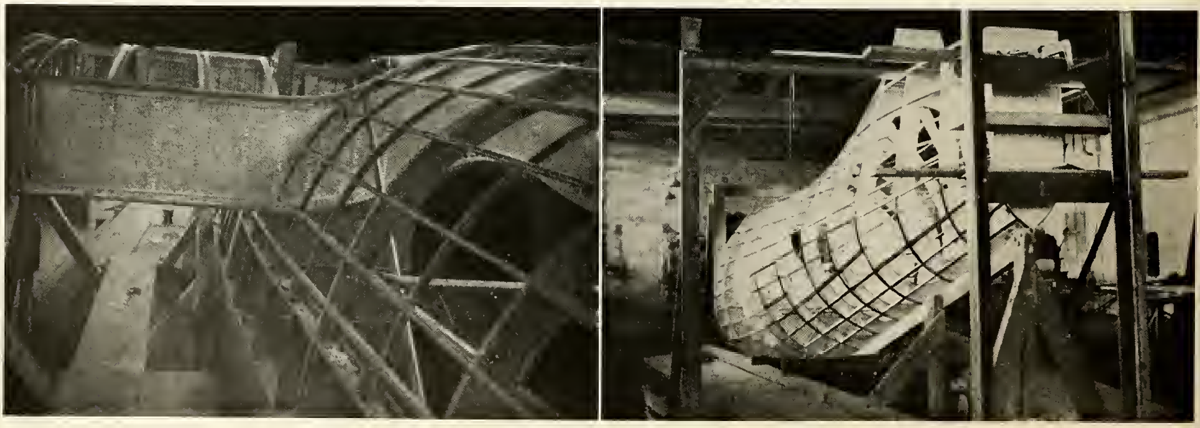
second compartment, for baggage, mail or other cargo, is accessible from the deck through a hatch, and a watertight door leads into the cockpit which is the next compartment aft.

Dual controls are provided, with engine controls and electrical switches arranged in the cockpit roof. Flight and engine instruments are grouped on rubber-mounted panels, and the selecting lever, electric switch and hand crank for the retracting mechanism gear box are installed between and above the pilots' seats. When the hatches above the seats are opened, they can be used as platforms for working on the engine.

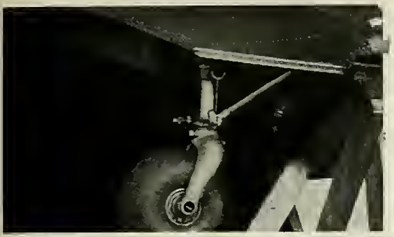
A watertight door leads aft from the pilots' cockpit into the center cabin, which has four adjustable and rubber-mounted chairs. A shelf near the cabin ceiling on the left is for storing life preservers, and the opposite shelf can be used for parcels. An emergency exit hatch is provided on the ceiling of this cabin, leading to the top of the wing center section. Another watertight door further aft leads into the second passenger compartment which also is equipped with four chairs. To the rear of the cabin is the lavatory. The capacities of these compartments is such that the plane will float safely even with two adjacent compartments flooded.

Cabin entrance and exit is through a hatch door aft of the second cabin, with a fixed stairway inside, and a folding ladder outside of the plane. The space opposite the inside stairway can be utilized for storing baggage.

Each cabin is soundproofed and has four fixed shatterproof glass windows and two electric dome lights. Ventila-



Metal hull construction of the ten-place Fairchild amphibion transport



Tail wheel aft of second step

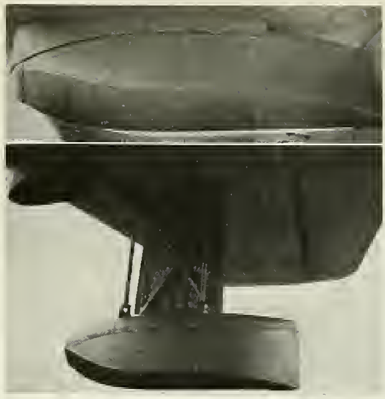
tion and heating is provided by ducts which run alongside the upper part of the cabin side walls.

Wings, Ailerons, Flaps, Tail Surfaces

The 13-ft. wing center section, which is riveted to the hull, is of two-spar construction and contains two fuel tanks of 180 gallons total capacity suspended between the spars. The front spar of this section is built of an upper and a lower flange with a dural sheet "wandering" web, and its wing nose portion is metal-covered. The lower flange, made of a dural extrusion serves also as a rail for the landing gear retracting trolley thus saving weight and avoiding complicated fittings and braces. The landing gear loads are carried into the spars without eccentric moments.

The rear spar of the wing center section is curved above the hull center giving adequate door height; the trailing edge behind this spar is fabric covered. The entire underside panels between spars are removable for inspection and maintenance, and are secured to stringers by elastic stop-nuts.

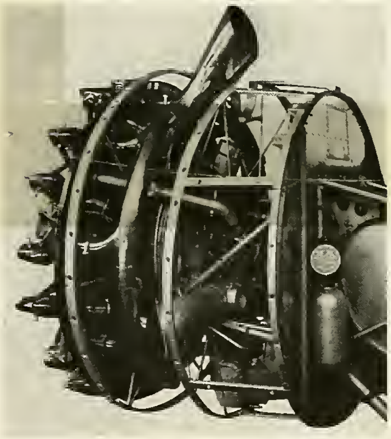
The outer wing sections are detachable and are built on two spars with thin sheet webs and dural extrusion flanges. The top covering of the entire wing is made of an inner layer with corrugations running parallel to the spars, and an outer layer of flat sheet riveted to the corrugations.



Wing float retracted and extended

Metal is used in the frame and nose sections of the ailerons, but the entire surface is fabric-covered. Ailerons are statically mass-balanced by lead weights enclosed in the wing at all except large up-aileron angles and carried on arms projecting forward from the hinge line.

Trailing edge flaps are of all-metal construction attached to the wing by slide fittings at the flap leading edge and links close to flap trailing edge, and are actuated by cables which wind around a grooved drum in the hull. These cables are attached to the flap slide fittings which can move fore and aft on flap slide tracks mounted on the rear spar.



Engine mount of the Fairchild amphibion

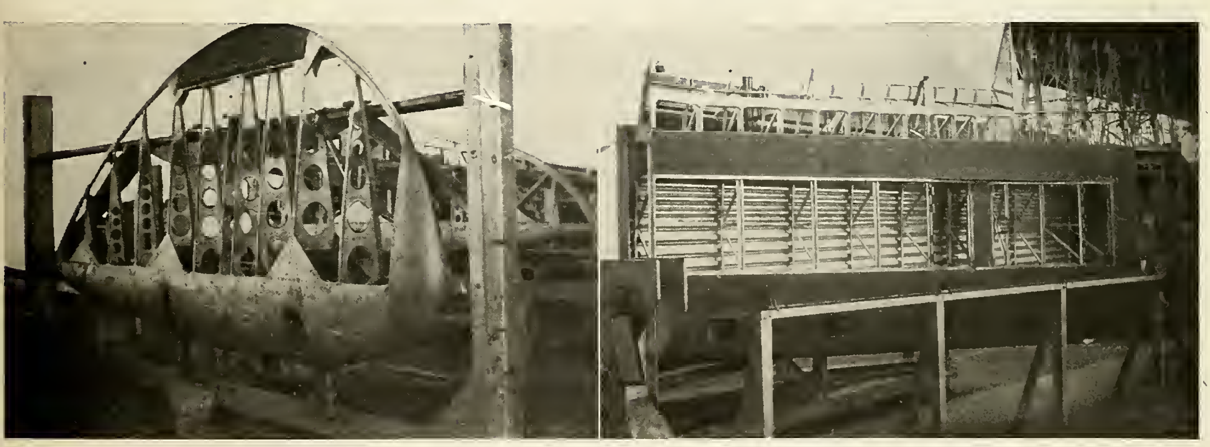
Inner portion of wing flap

Tail surfaces are of dural frame and are fabric covered with exception of the nose parts, which are covered with dural sheet beneath the fabric. Stabilizer and fin are integral with the hull and are braced by streamline tie rods. All control surfaces are equipped with trim tabs.

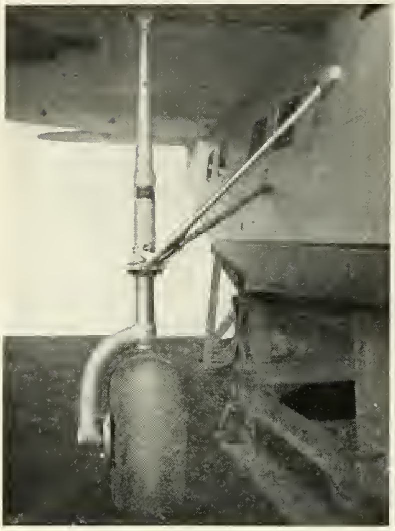
Landing Gear, Tail Wheel, Floats

The landing gear structure is so designed that the wheels fold rearwards and upwards, rotating slightly around the shock strut axis during the retraction so that they are flush with the underside of the wing when fully drawn in. The operation is accomplished by turning a spindle (installed inside the front spar flange) which in turn operates a trunnion on the wheel trolley causing the trolley to move inboard or outboard. The landing gear side brace struts are attached to the shock strut by a universal joint, and a torque stop is provided on the side brace strut unit to prevent torsional loads to be carried up to the spar trolley. The tail wheel, which retracts simultaneously with the landing gear, is drawn into a well on the underside of the hull aft of the second step.

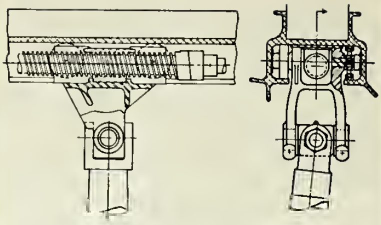
Wing tip floats retract against the un-



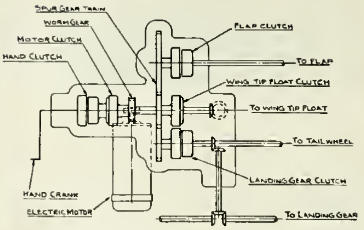
Metal structure of rudder and wings as fabricated in vertical jigs



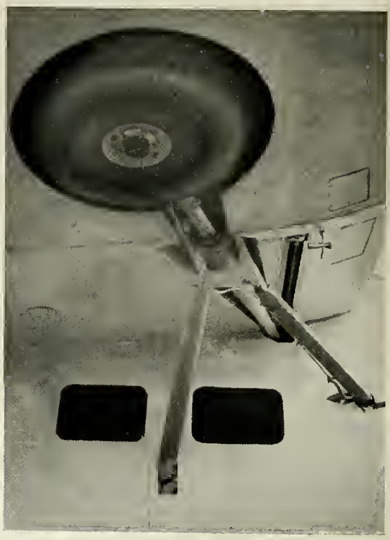
Landing wheel extended



Transverse trolley detail



Master gear mechanism



Landing wheel retracted

derside of the wing by a parallelogram arrangement of struts. Spindles and trunnions (the retracting struts are attached to the latter) operate the floats, and a recess is provided in the underside between the spars so that the float brace struts are fully concealed inside the wing. A metal panel attached to the outer brace struts hides the float mechanism when the floats are retracted.

With three retractable units, the problem of operating each separately was solved by the use of an electrical system with only one hand crank (for emergency use only), one motor, and a gear box to divert the driving power to the landing gear, flaps or tip floats, one at a time, when and as required. It was necessary to devise clutches which could be engaged or disengaged at any position of the driving and driven member in the gear box, and the electrical hook-up had to be developed.

The drive system for the landing gear mechanism consists of the aforementioned spindle with trunnion, to which the retracting trolley is attached. The spindle is turned through a drive shaft system from the respective gear in the master gear box which is engaged by operation of the clutch selector lever. When the electric motor is switched on, the drive shafts and spindles turn, the trunnion moves the shock strut trolley (in-or-outboards as the case may be for retracting or lowering of the landing gear) and when the trolley reaches a point close to the extreme position, it engages a limit switch, the electric current is interrupted and the spindle and trolley stops.

The electrical contact system was so designed that, with changing the position of the selector lever, for instance, from landing gear to flaps, the interconnection of the travel limit switches also change to suit.

Nacelle

The nacelle structure, of welded chrome molybdenum steel tubing, is attached to the wing center section at one point at the rear spar and two at the front spar. The engine is supported by rubber bushings which allow only slight movement of the engine in the direction of engine torque and no movement fore and aft. A full NACA type cowl which fairs into the nacelle cowling is used. The rear portion of the nacelle cowling can be utilized as storage space for baggage or equipment, and the front part houses the 15-gallon oil tank, oil cooler, engine controls and accessories.

Specifications and performances at sea level unless otherwise specified, with the P. & W. Hornet 650 h.p. engine are as follows:

Wing span	56 feet
Length overall	46 feet
Wing area	485 square feet
Ailerons	37 square feet
Stabilizer	45 square feet
Elevator	35 square feet
Fin	34.4 square feet
Rudder	24.4 square feet
Flaps	64 square feet
Weight empty	5500 pounds
Crew	340 pounds
Fuel	1020 pounds
Oil	112 pounds
Marine equipment	83 pounds
Miscellaneous equipment	100 pounds
Payload	2445 pounds
Useful load	4100 pounds
Gross weight	9600 pounds
Useful load (% gross weight)	42.7%
Wing loading	19.78 lbs./sq. ft.
Power loading	14.76 lbs./h.p.
Maximum speed	179 miles per hour
Maximum speed (at 3000 ft.)	184 m.p.h.
Cruising (3000 ft. at 65% power)	158 m.p.h.
Rate of climb	900 feet per minute
Service ceiling	18,000 feet
Absolute ceiling	20,000 feet
Stalling speed without flaps	68 m.p.h.
Stalling speed with flaps	58 m.p.h.
Cruising range	750 miles
Take-off time on land	16 seconds
Take-off time on water	36 seconds

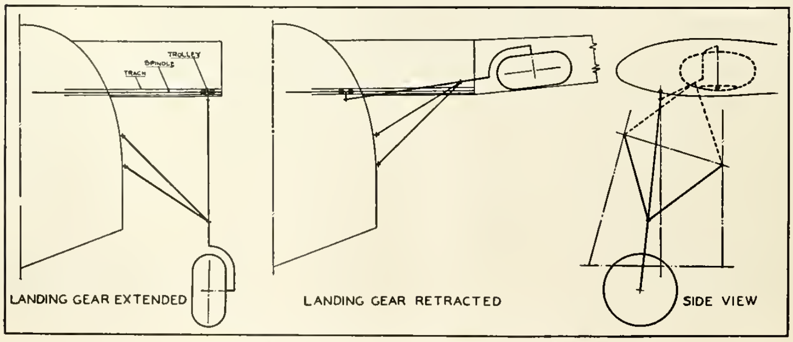
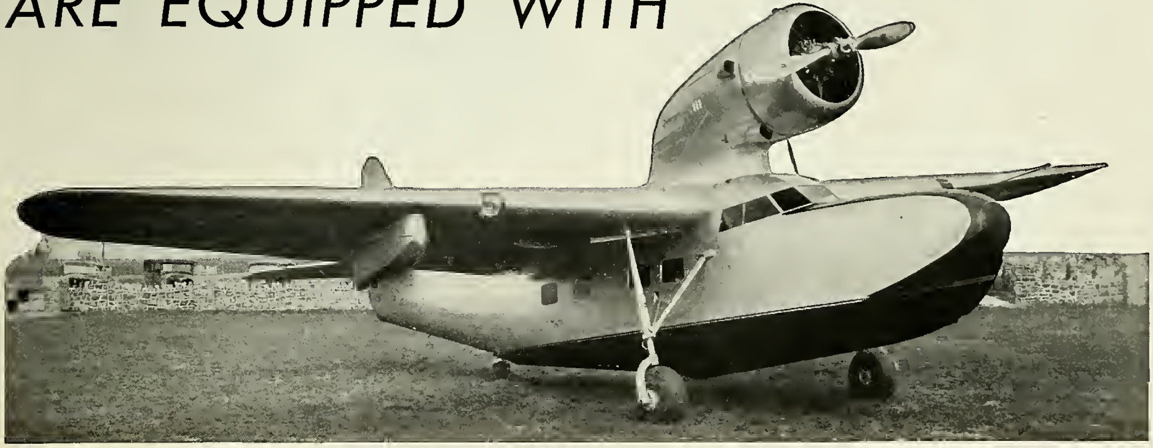


Diagram showing travel of Fairchild landing wheel unit

PAN-AMERICAN AIRWAYS' FAIRCHILD AMPHIBIONS ARE EQUIPPED WITH



PRECISION BEARINGS

The **Fairchild** Model 22 two-place monoplane (above) and the **Fairchild** Model 24 three-place monoplane (below) also carry their complement of **Norma-Hoffmann Precision** Bearings at vital points.

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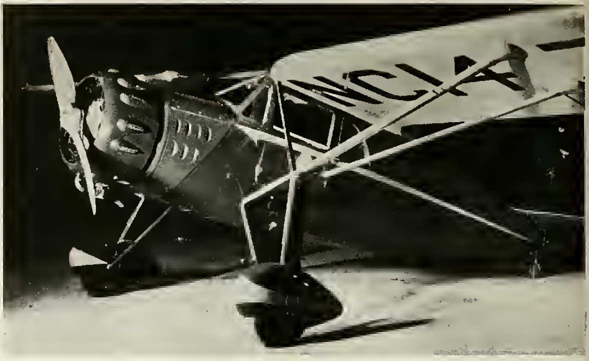
PRECISION BALL, ROLLER, AND THRUST BEARINGS

Improvements in the 145 H.P. Fairchild Models "22" and "24"



Fairchild "24" with 145 h.p. Warner Super Scarab engine

● Improvements in structural and aerodynamic detail are incorporated in the new 1935 models "22" and "24" recently completed by the Fairchild Aircraft Corp. Both show numerous refinements over previous models, and the engineering developments of the Hagerstown factory during the past year are utilized to provide more comfort, greater speed, and an even more efficient airplane than before.

The 1935 "22" is a 145 h. p. Warner Super Scarab-powered two-place open cockpit monoplane which represents an aerodynamic improvement over the 1934 model. The fuselage has been altered to accommodate an NACA cowl similar to the one used on the model "24," and the fuselage turtle deck has been made higher to eliminate a special metal bulkhead.

Flight characteristics have been improved by the use of an N22 wing section, slot-type ailerons, and an empennage similar to the "24," thus giving increased maneuverability and better stall characteristics. The aileron slot arrangement, for instance, produces a diversion of the airflow underneath the wing, at a high angle of attack, through the slot. As the airflow is scooped up by the slot when the aileron is moved, the air is forced out through a smaller aperture at the top of the aileron, thereby considerably intensifying the flow of the air over the top of the aileron and securing aileron effectiveness even in a burble point position.

Metal parts are anodized, cadmium plated or baked enameled. The fuselage is sand-blasted before being coated with aluminum oxide. The various coatings of paint are sanded, water rubbed and polished to a mirror-like finish. Wheel pants, oleo spring landing gear, complete fairing and fillets, dual controls, electric starter and battery, navigation lights and tail wheel are standard equipment.

The Warner Super Scarab-powered Fairchild 24 also has many refinements and improvements, incorporated after a study of the use made of the 1934 model 3-place cabin planes in service.

Outstanding are the greater comfort and refinement of the plane's interior, and the increased gross weight to accommodate extra baggage and equipment.

By studying the advances made in modern automobiles it has been possible to incorporate in the new "24" an unusual degree of comfort in the three seats, which have been re-designed, the rear seat being made more accessible and roomier. The same general seating arrangement is still used—two seats forward and one single seat in the rear—but by using seat packing the cushions have been made considerably softer. The cord cloth used for covering the seat and back cushions instead of leather or imitation leather, is not only durable and attractive but allows the use of a soft spring filled packing.

The framework of the seats is of steel tubing with all visible parts chromium plated, and a heavy canvas forms the base for the seat and the back cushion. The pilot seat is now adjustable in flight, while the right-hand passenger seat has been altered to make access to the rear seat more convenient.

In order to conform to the new seat upholstery, the cabin is lined with a cloth of a harmonizing color, and the beading and trimming add a touch of refinement. Chromium plated Catalin knobbed hardware is used.

Fittings include glove and map compartments, ash-trays, assist cords, sun shades and carpet.

Main structural features of this year's model are practically identical to the 1934 model. Engineering changes add structural strength and improved aerodynamic characteristics. Fuselage lines are more rounded and the landing gear is aerodynamically cleaner. The oleo-spring type tail wheel improves taxiing and eliminates a certain amount of maintenance.

Gross weight has been increased to permit an unusually large amount of luggage and extra equipment to be carried. The structural changes, though increasing the strength of the airplane, have not increased the empty weight, and the payload, including pilot, under the new gross weight of 2400 lbs., is 747 lbs. The empty weight of 1457 lbs., includes a wood propeller, landing lights, heater and ventilator, radio, standard instrument installations, turn-and-bank and rate of climb indicators, generator and engine shielding. When a metal propeller is used 33 lbs., are deducted from the baggage allowance or from the 67 lbs. of special equipment that has been specified in the empty weight.

Other features include a complete ball-bearing control system, including hinges on ailerons, elevator and rudder; cadmium-plated fittings on wings, struts, and landing gear; sand-blasted and aluminized-oxide coated fuselage; baked-enamel on compression struts and aileron brackets; and anodically-treated lift-strut-wing connections, bay trusses and center section spar fittings.

Specifications and performance of the Fairchild "22" and "24" appeared on page 72 of the April, 1935, Aero Digest.

●

Fairchild "22" two-place open cockpit plane powered with a 145 h.p. Warner

●

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7 questions

you should ask of any school you are considering

1. Has the school a "playboy flying school" reputation — or is it known for long hours of intensive, serious work?

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Boeing School is a division of United Air Lines Transport Corporation, which *flies more passengers, more planes, more mail, more miles, than any other line in the world.* Can you think of any school as well equipped to prepare you for a career in aviation?

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Boeing graduates are today going ahead as: scheduled air transport pilots, co-pilots, test pilots, sales pilots, field traffic men, traffic representatives, airplane mechanics, aircraft engine mechanics, hangar and field service mechanics, metals mechanics, factory workers, radio operators, radio technicians, dispatchers, instruments mechanics, instrument technicians, field secretaries, field managers, aeronautical engineers, in the employ of many leading companies.

6. How does the U. S. Government rate the school?

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Simon Radioguide for Aircraft

HENRY W. ROBERTS

● The Simon Radioguide, shown schematically in figure 1, is a radio navigation instrument, showing the direction of the radio transmitting station in degrees off the craft's bow, right or left, and simultaneously indicating, on the same dial, the ratio of the distance travelled towards, or away from, the transmitting station. It permits navigation of aircraft on a direct course and at the correct drift angle, towards any radio transmitting station. The exact position of the airplane can always be determined at any time without changing the course, by merely tuning in on one additional station and observing its bearing, in degrees, on the same dial.

The apparatus is non-ambiguous, i.e., it gives only one true course. It operates on frequencies from 3000 to 150 kilocycles (approximately 100 to 2000 metres), and is capable of reproducing signals as low as 2 microvolts in intensity, giving it a practical operating range up to 2000 miles under favorable conditions. A steady dial reading is obtained on both modulated and non-modulated radio waves without destroying the characteristics of the received signal, and the apparatus is exceptionally free from "night error."

Reception of all course indications is visual; aural reception, however, is also provided for positive identification of the transmitting stations, reception of weather reports and range beacon signals, or broadcast entertainment, and may be used by the pilot at will without affecting the reading of the course-indicating instrument.

Physically, the Simon Radioguide consists of two fixed loops, 10" in diameter, mounted in a vertical plane at an angle of 60° to each other and to the transverse axis of the airplane (see figure 1). They are completely shielded with duralumin, and mounted either outside or inside the airplane, the latter installation being preferred as it does not increase drag and permits reduction of weight and greater electrical efficiency by the use of shorter feed lines to the receiver. The loops may be mounted in close proximity to each other, provided that they are in a "no-coupling" position, i.e., that there is no electrical interference between the two loops. The inventor of the Radioguide, Emil J. Simon, is responsible for much original work on "no-coupling" positions between coils, with the result that such compact installations as that in the Bellanca airplane "Irish Swoop" (figure 2) are now possible.

The loops are interconnected electrically on one side, while the opposite side of the circuit is fed, by means of a common detector-oscillator tube, to two separate channels of radio-frequency amplification stages of a special dual-channel superheterodyne receiver. The final amplification stage of each channel actuates one of the two crossed pointers of the course-indicating instrument, the deflection of the pointers being proportional to the strength of the signal. Here we have, in effect, two separate radio receivers, each reproducing, by means of its pointer on the indicating instrument, the strength of the signal picked up by its corresponding loop.

Each channel of amplification is provided with its independent volume control, making possible fine adjustment of the apparatus to meet any operating condition. A balance switch in the loop circuit permits, in one position operation of the two loops as one, and the volume output of the two channels to be balanced by obtaining identical readings on the course-indicating instrument. With the switch in the second position, the loops operate separately, making the apparatus directional, as the deflection of each pointer then becomes proportional to the strength of the signal received by its respective loop.

The audio-frequency amplification stage (for reproducing radio impulses as sound) is common to both loops, and the volume of the audible signal, therefore, remains substantially constant irrespective of the course.

The entire apparatus, thus, consists of the two loops, the receiver with its course-indicating instrument, and some

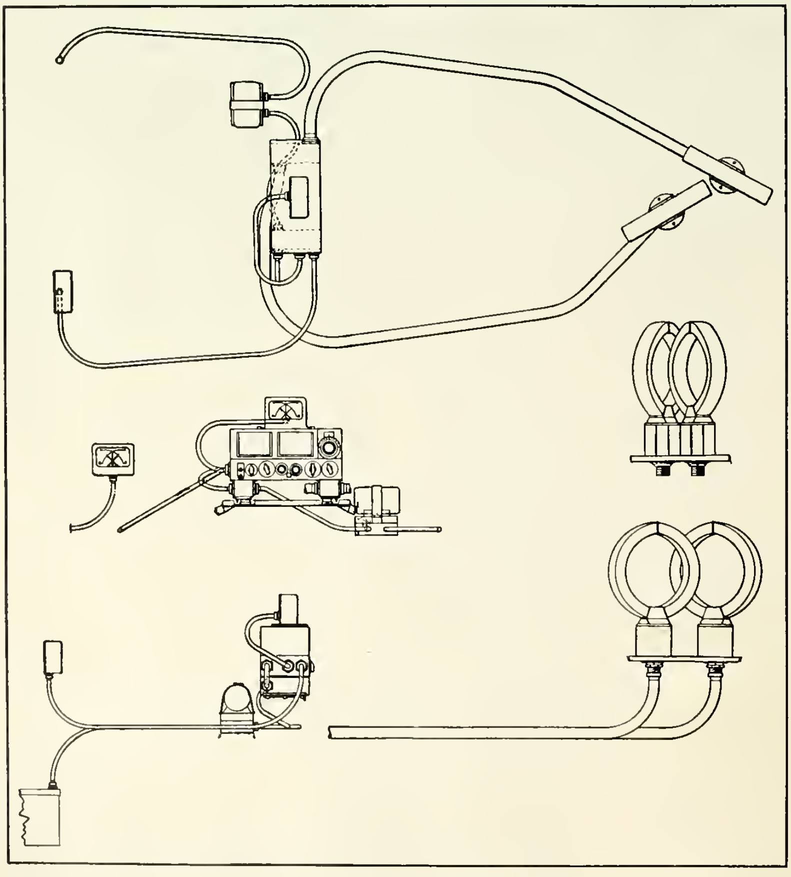


Figure 1. Plan, sectional and port elevation views showing assembly of the Simon Radioguide as installed in the Bellanca "Irish Swoop" racing plane

standard means of power supply best suited to the airplane, such as used for an ordinary radio receiver. The entire apparatus (exclusive of the power supply) weighs less than 30 lbs.

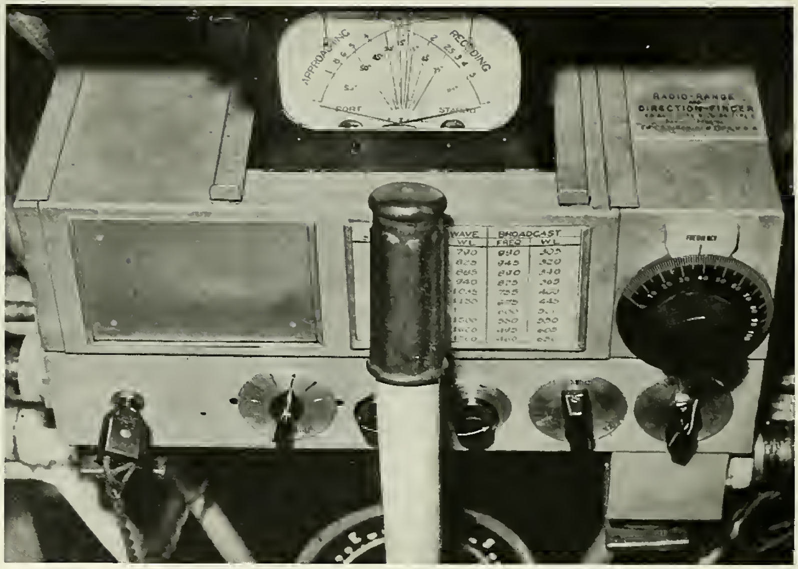


Figure 2. Simon Radioguide installed in the rear cockpit of the "Irish Swoop"

Operation

The principle of operation of the Radioguide is simple. A verticle loop is most receptive to radio signals emanating from points lying within its plane, and least receptive to those at right angles to it. From figure 1, it is obvious that as long as the source of signals lies directly ahead (or directly behind) the airplane, both loops register equally. A deviation from that course results in one loop registering an increase in the signal strength, while the other shows a proportional decrease. The corresponding deflection of the two crossed pointers measures the deviation in degrees on the calibrated dial of the course-indicating instrument.

The loops thus operate on 50% to 80% of the maximum signal, giving long-range bearings correct to within 1°.

The use of the two loops permits graduation of the dial in degrees, since the course reading is obtained by the ratio of the signal strength in the two loops, which remains constant irrespective of the signal strength, and which varies with distance from the station. At the same time, since at distances under 100 miles the signal strength is approximately inversely proportional to the distance from the radio station, the distance dial can also be calibrated to show factorially the ratio of the distance travelled to an initially known distance.

In actual operating practice, the pilot first turns the balance switch to the non-directional position, and by means of the two volume controls, causes the pointers to cross anywhere on the zero-degree line of the course dial; the position of the pointer is then noted on the proper side of the distance scale: "Approaching," if flying towards the station, or "Receding," if flying away from it. The receiver is then switched to the directional position, and the correct course indication is obtained by reading the angular scale on which the pointers intersect. The progress of the aircraft is simultaneously indicated on the appropriate distance scale of the same instrument.

The pilot usually knows, by his compass bearing, whether he is heading towards or away from the radio station which he has selected; however, this can always be verified, either by observing the gradual movement of the pointers on the distance scale, or by pressing the "sense button" on the instrument, which gives a positive and instant indication of whether the radio station is ahead or astern.

While a radio direction finder theoretically enables the pilot to fly the Great Circle course towards a radio station, in practice any cross-wind will cause the airplane to deviate from that course and follow instead a spirally curved path, the curvature of which depends on the speed of the airplane and the direction and velocity of the cross-wind. The Radioguide, used in conjunction with the compass or a directional gyro, is a precise drift indicator, and permits the pilot, independently of all other navigation instruments, to fly blind the Great Circle course without knowing the direction or the velocity of the wind. The pilot obtains a direct reading of the ship's drift by observing the drift of the pointer intersection, to the right or left of the zero-line, and changes his course until the pointer intersection becomes stable, giving him the correct drift angle in degrees, while guiding him to the radio station along the Great Circle route.

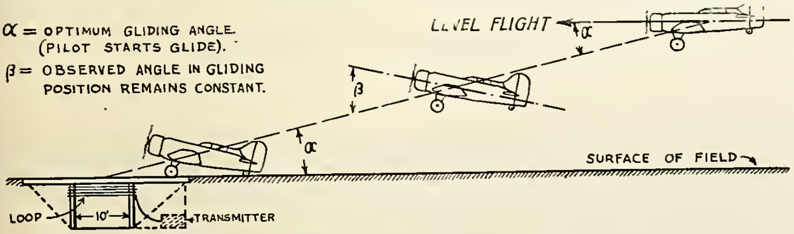

α = OPTIMUM GLIDING ANGLE (PILOT STARTS GLIDE).
β = OBSERVED ANGLE IN GLIDING POSITION REMAINS CONSTANT.
LEVEL FLIGHT
α
β
α
SURFACE OF FIELD
LOOP
10'
TRANSMITTER

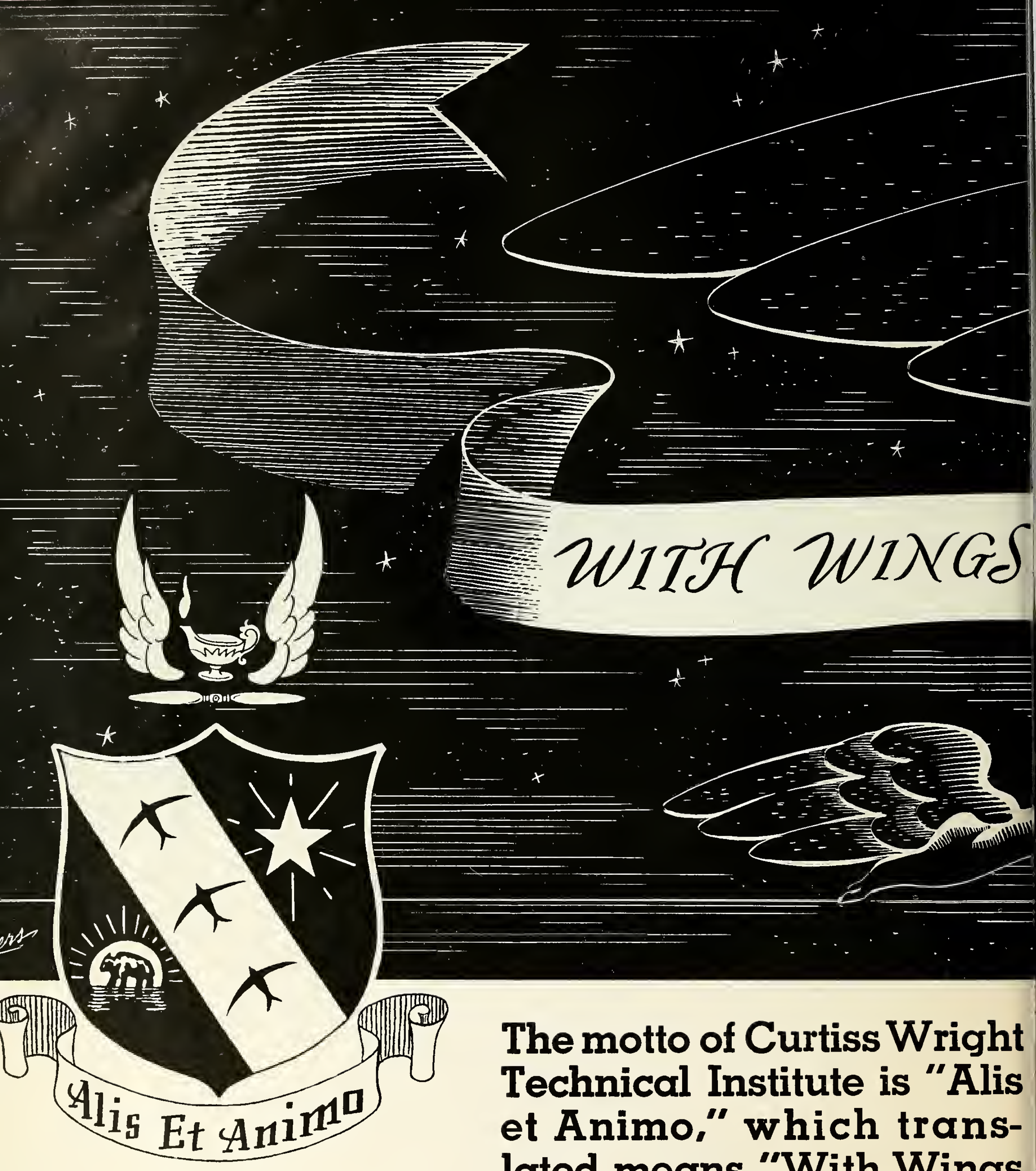
Figure 3. Radioguide instrument landing installation at Floyd Bennett Field

This apparatus permits flying a true Great Circle course away from a radio station, and flying it at the correct drift angle without knowing the wind conditions. In this case the readings of the course-indicating instrument will be reversed.

The exact position can always be determined by tuning in on one additional station, observing its bearing in degrees off the course, and plotting the resultant findings on a map.

Work is now in progress at Floyd Bennett Field in New York on the installation of the first blind landing system employing the Simon Radioguide principle as described in the preceding paragraphs. The ground equipment consists of an automatic radio transmitter utilizing a horizontal loop antenna, located underground in the middle of the airport. The concrete pit housing the equipment is covered with a 6" double floor of creosoted pine, and will safely sustain the landing impact of the largest airliner. No steel is employed in the construction, to avoid distortion of the antenna field pattern. The pit measures 8 feet in height by 10 feet square, and the loop antenna is wound around the 8" × 8" posts.

The method of operation is seen in the illustration of figure 3. Since the radio waves emitted by such an antenna are horizontally polarized, it is possible, with suitable receiving apparatus, to determine the direction of their source in three dimensions, and approach it from any direction and at any desired angle. Such a device is found in the same Simon Radioguide, but equipped with two loops mounted horizontally,



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Metal Coverings

Formulas and Process for Calculating the Strength of Plates and Metal Construction in Airplanes (Formeln und Berechungsverfahre. fuer die Festigkeit von Platten und Schalenkonstruktionen in Flugzeugbau), O. S. Heck and H. Ebner. Luftfahrtorschung, Vol. 11, *No.* 8, *February* 6, 1935, *pp.* 211-222.

FORMULAS AND methods of calculation are given for determining the stability and strength of thin sheet metal used for covering fuselages and wings of airplanes. The authors calculate the strength of rectangular isotropic, orthotropic and reinforced plates and round, cylindrical sheet-metal parts under compressive, shearing and combined stresses. They also compute the strength of complete round cylindrical sheet-metal parts under axial compressive stress, bending stress, stresses due to drilling and compound axial and radial stresses.

Detonation

The Effect of Variations in the Intake and Exhaust Pressures on the Detonation in an Internal Combustion Engine (L'influenza della variazione della pressione all'aspirazione ed allo scarico sulla detonazione in un motore a scoppio), P. Aymerito. L'Aerotecnica, Vol. 14, *No.* 12, *December,* 1934, *pp.* 1388-1413, 12 *figs.*

RESULTS of detonation experiments, made on a single-cylinder engine with a variable compression ratio, are discussed. The tests were carried out for three types of fuel and at constant intake-air and cooling-water temperatures, engine revolutions and ignition advance. It was found that the detonation increased as the differences between the intake and exhaust pressures increased and that if the intake pressure is higher than the exhaust pressure, detonation occurred at a lower compression ratio.

Weather Forecasting

The Italian Organization for Safe Flying (L'organizzazione Italiana per la protezione del volo), F. Porro. L'Aerotecnica, Vol. 14, *No.* 12, *December,* 1934, *pp.* 1347-1364, 1 *fig.*

OPERATION OF the various radio-meteorological services in Italy to promote safety in flight is described. These consist of four divisions covering the gathering of meteorological information, the determination of position and routes of aircraft, the necessary means of communication for receiving and transmitting information, and weather forecasting. The country is divided into eight zones in each of which a regional weather bureau provides weather forecasts, carries out research and assures all kinds of communications within the zones.

Aircraft Fuels

Fuels for Aircraft Engines, E. L. Bass. Royal Aeronautical Society—Preprint for Meeting March 1, 1935, 57 *pp.*, 43 *figs.*

THE KNOWN practical effects and influences of detonation are discussed. In describing various means for detecting detonation on full-scale engines, the author includes observation of the occurrence of the exhaust smoke and appearance of the exhaust flame, as well as measurement of power output, heat losses, combustion pressures, rate of pressure rise, cylinder-head temperatures, and of exhaust-gas temperatures.

He explains the C.F.R. method and temperature-measurement experiments carried out on the E.35 engine to determine the effects of mixture strength, fuel anti-knock characteristics, intake mixture temperature, and ignition timing. He takes up the determination of the relative anti-knock values of fuels under laboratory conditions to give results similar to those obtained on the full-scale engine. He considers the boiling range of considerable importance and points out its control over startability, distribution, lubricating oil dilution, and the tendency to form ice in the carburetor as well as its relation to the vapor pressure of the fuel. The effect of freezing point, specific gravity, viscosity, calorific value and the water, gum and sulphur impurities are also explained.

Seaplanes

Investigation of the Accident to the Flying Boat J-BCDO "Sirohato." Tokio Imperial University, Aeronautical Research Institute—Report No. 116, *Vol.* 9, *No.* 8, *January,* 1935, *pp.* 195-437, 66 *figs.*

CAUSES OF the crash of the 6-passenger airliner of the Dornier Wal type monoplane which was built by the Kawasaki Aeroplane Company were investigated for this report. The investigation included a study of atmospheric conditions at the time of the accident, statical calculations, experiments with wing flutter, calculation of the free vibration of a spar, cinematographic study of the development of the accident, study of the fractures and deformations, wind-tunnel experiments and an examination of the damages to the structural members. It was determined that the primary cause was an overstretched control cable which vibrated in bumpy air resulting in the disconnection of a turnbuckle and causing flutter of the wings.

Load Factors

Limits in the Use of Flying Equipment and the Load Factor (Limites d'emploi du matériel volant et facteurs de charge), P. Leglise. L'Aéronautique, Vol. 17, *No.* 189, *February,* 1935, *(L'Aérotechnique Supplement) pp.* 13-17, 8 *figs.*

A METHOD is proposed by the Dewoitine Airplane Company for calculating the load factor and the limits to which an airplane may be used in function of the strength of the framework. The method takes into account the forces encountered from gusts of wind, the forces acting on the framework at all the incidences and with all possible movements of the ailerons, and the minimum speed of flight for an airplane.

Wing Vibration

Free Bending Vibrations on a Cantilever Wing (Bibrazioni flessionali libere di ali a sbalzo), C. Minelli. L'Aerotecnica, Vol. 14, *No.* 12, *December,* 1934, *pp.* 1371-1387, 22 *equations.*

THE PROBLEM is taken up of determining the frequencies in the free bending vibration of a cantilever wing possessing chord, mass, rigidity to bending, and elastic and aerodynamic damping distributed according to the parabolic law along the wing. The author calculates the frequencies by means of various combinations of values for the exponents of the parabola.

Seaplane Testing

Research in the R.A.E. Tank, L. P. Coombes. Royal Aeronautical Society—Preprint for Meeting, February 22, 1935, 21 *pp.*, 23 *figs., Bibliography.*

RESEARCH WORK which has been carried out on seaplanes in the tank of the Royal Aircraft Establishment is described. The author discusses the solution for such problems as calibration of the tank, measuring apparatus and balances, wall interference, and depth and scale effects. He outlines tests made in accelerated motion and reviews the improvements in hull design which were obtained by tank research. He explains how the R.A.E. attacked the problem of longitudinal instability or porpoising and refers to a balance which is being designed for measuring yawing moments.

Photoelasticity

Practical Use of Photoelasticity Measurements in Aeronautical Structures (Utilité pratique de la Photoélasticimétrie dans les Constructions Aéronautiques), M. V. Tesař. La Technique Aéronautique, Vol. 25, *Nos.* 133, 134, 1934, *pp.* 213-225, 38 *figs.*

APPLICATIONS of the photoelasticity method for measuring the distribution of internal stresses on model cross sections of structures used in aircraft and engines are discussed. This is an experimental optical method used with models of transparent material. The author begins the second installment with a study of a plane model of a crankshaft, illustrating the concentration of internal stresses and how they are measured. He explains photoelastic studies on dynamic problems, and the determination of elastic stresses in actual structures.

The February 15 issue of *Engineering* (pages 183-185, 15 figs.) contains an article by E. G. Coker entitled "The Design and Equipment of Photo-Elastic Laboratories" in which all the essential requirements of such a laboratory are described.

Wooden Spars

The Bending Strength of Sosna Pine Spars (Wytrzymalosc zginanych dzwigarow sosnowych), J. Naleszkiewicz. Sprawozdania, Instytut Badan Technicznych Lotnictwa (Institute of Aeronautical Research), Warsaw, Vol. 7, *No.* 2 (14), 1934, *Report No.* 61, *pp.* 5-143, 100 *figs. and* 15 *figs. on supplementary plates. Bibliography.*

RESULTS OF tests are described which were carried out on Sosna pine specially chosen and qualified for aircraft structures. The theory of pure and eccentric bending of rectangular beams and box spars is discussed and compared with the test results on box spars. The trapezoidal theory is applied to the construction of pine spars

Racing Engines

The Preparations for a High-Speed Engine (La preparazione del motore del primato di velocità), E. Vandone. Rivista Aeronautica, Vol. 10, *No.* 12, *December,* 1934, *pp.* 408-450, 21 *figs.*

PREPARATIONS INVOLVED in the design of the Fiat racing engine for the Schneider Cup Race in 1931 and for the 3100-hp. engine powering the plane in which Francesco Agello set the seaplane speed mark of 440 miles per hour in October are discussed. The author describes the particular characteristics and structure of these engines and the results of tests with the single cylinder, as well as bench and flight tests with the completed engine. He takes up the carburetor problems for such a high-speed engine and illustrates curves obtained in test flights showing the plane's velocity, engine r.p.m., and carburetor valve opening for the duration of the flight in seconds.

NEW EQUIPMENT and METHODS

Goodrich Plastic Koroseal

• A NEW plastic material, said to be superior to rubber for the manufacture of a wide variety of products, has been developed by the research departments of the B. F. Goodrich Company, Akron, Ohio.

The material may be molded into any shape, resists the action of various chemicals injurious to rubber, and possesses even greater flexing life than rubber, according to Goodrich engineers.

Known as Koroseal, the new Goodrich product is not expected to replace rubber in general use but will be applied in some instances where rubbery consistency, combined with superior resistance to certain oils and chemicals, and where flexing is required.

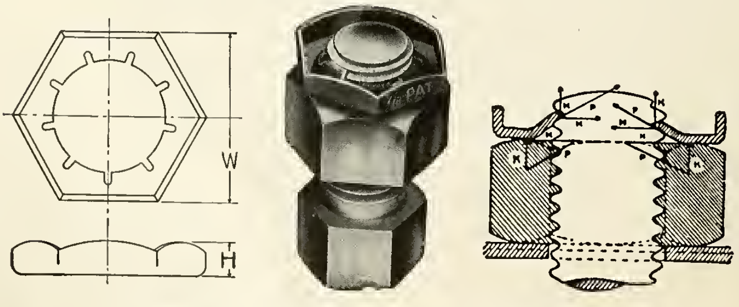
Lock Nuts

• THE PALNUT is a single thread spring steel nut applied on top of the regular nut to lock it in place, after the regular nut has been tightened. The Palnut fits the screw thread perfectly, spins on with the fingers and locks tight with ⅙ of a turn with the wrench. Once on, the Palnut will hold tight under any vibration condition.

Manufactured by The Palnut Co., Irvington, N. J., these units are light in weight, and come in sizes ranging from #6 to ¾". The principle of the Palnut is illustrated in the accompanying diagram. The working part is in the form of a coned disc (with prongs) whose inner circumference fits snugly around the root of the bolt thread. The turned-up sides afford an adequate surface for a wrench.

When the nut is tightened, pressure at *KK* tends to flatten the prongs, making them grip the root of the bolt thread. It is evident from the low angle of the prongs that a pressure along the lines *KK* will cause a much greater component force along lines *HH*, thus giving the Palnut its grip in the bolt thread.

The Palnut takes no bolt load from the regular nut, but its resilient grip wedged in the root of the thread prevents the regular nut from working loose.



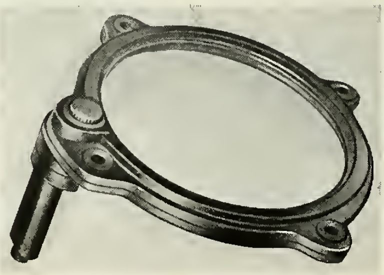
Diagrammatic sketch and application of Palnut lock nut

Pioneer Ring Light

• PIONEER INSTRUMENT CO., has developed a system of instrument illumination known as the Pioneer Ring Light which answers the requirements for proper individual instrument illumination at all times.

Light is conducted through a curved glass rod which encircles the dial. The dial markings and pointer are illuminated evenly and there is no glare or reflection regardless of the angle from which the instrument is observed.

A standard cover glass is used which carries no electrical contacts so that glasses may be replaced or the movement removed without disturbing the lighting system. Electric connections are outside the case, and are rugged and unaffected by vibration. Wiring is completely shielded up to the bulb, which is of special construction to insure long life and which may easily be replaced during flight.



Pioneer instrument ring light

These units are supplied either built into the cases of new instruments or as an adapter which can be installed on any standard instrument.

Propeller carrier made by TWA

Propeller Carrier

• WHEN A Douglas Airliner rolls into the maintenance base of Transcontinental & Western Air at Kansas City for engine overhaul, mechanics remove the propellers and place them on a dolly for transport to the propeller room. There they are inspected, adjusted, repaired and made ready for replacement.

This dolly, made in TWA's shops, not only saves time by allowing one man to move two propellers from plane to shops and from shops back to plane, but also avoids the danger of damaging them. Formerly three men were required to handle one propeller.

Muffler For Aircraft

• BY MEANS of a new-type of muffler adaptable for aircraft, buses and trucks, Ralph Rosenberg of the Detroit Automotive Development Co., has shown through laboratory tests that not only is the dangerous carbon monoxide gas as well as the smell of unused gases eliminated by burning the gases and converting them into carbon dioxide gas, but that the construction of the muffler also reduces the noise of the engines.

In this device, exhaust from the engine is mixed with an auxiliary airstream in a special burning chamber within the muffler. The additional air is put into turbulence by spiral ducts entering the chamber. The gases are fired by a buzzer spark plug which is switched off when the new mixture is ignited and continues to burn as long as the engine is in operation. Danger of fire is removed as the chamber combustion passes through a miners safety lamp screen. At this point in the final exhaust, a part of the air from the auxiliary intake line passes around the burning chamber outlet cooling it so that the exhaust noise is lessened.

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AIRLINES AND AIR TRAVEL

34,998 Passengers In February

ENCOURAGING SIGNS of increasing passenger traffic on the airlines are seen in reports of the Bureau of Air Commerce, Department of Commerce, and from transport operators. Twenty-one companies operating in continental United States carried 34,998 passengers in February, 1935, compared with 28,922 in the preceding month and 27,624 in February, 1934.

Those scheduled airlines flew 3,348,624 miles, carried 171,818 pounds of express, flew 16,232,291 passenger miles and 114,864,954 express pound miles during February.

A new passenger record was established in March by Pennsylvania Airlines and Transport Company, on its Washington-Detroit-Milwaukee route, when 3,160 passengers, almost seven times the number carried during March of any previous year, and almost twice the number carried in October, 1933, the previous best month in the company's history, were transported. The majority traveled on the Washington-Pittsburgh-Akron-Cleveland-Detroit division, although a substantial increase was also shown between Michigan cities on the Detroit-Milwaukee division.

Schedule Revisions

ANOTHER ROUND-TRIP between Dallas and Tulsa has been added to American Airlines' service, a ship now leaving the former city at 3:48 p.m. and Tulsa at 6 p.m. This is the third schedule operated by the company between the two cities. In addition, day service to Little Rock will be resumed following the addition of 52 acres to the municipal field which provides better facilities for landing, and just as soon as an abandoned road through the field is graded, the airport will have a 4200-foot runway. Further increases in schedules were made between Chicago and New York, and Chicago and St. Louis and a second flight to South Bend will be started soon. With another schedule flying between Chicago and Detroit, seven round-trips are in operation each day. There are four round-trips now operating between Chicago and St. Louis, two of which continue to Tulsa, Dallas and Ft. Worth.

Night passenger service between Dallas and Kansas City, using Lockheed Electra transports, will be inaugurated June 15, according to T. E. Braniff, president of Braniff Airways.

Installation of new Vultee planes by Bowen Air Lines has cut an hour from the flying time between Brownsville and Dallas, and 30 minutes between Dallas and Houston. The new schedules bring Dallas within less than nine hours of Mexico City and makes possible night connections for night planes bound for the north, east and west.

Overnight air mail service between St. Louis, Chicago and New Orleans, was inaugurated April 1 by Chicago and Southern Air Lines, Inc. The route is fully lighted and equipped with radio, and intermediate field facilities.

Night air mail schedules between Atlanta and Dallas will be inaugurated May 10 by Delta Airlines, according to Clarence E. Faulk, president, who said tri-motored Stinson Model A Airliners of the latest type will be used.

National Park Airways initiated a second mail, passenger and express service between Salt Lake and Great Falls, providing daylight operations along the route.

W. A. Patterson, president of United Air Lines, announced that scheduled mileage has been increased 4000 miles daily, bringing the total monthly mileage covered to 1,200,000 miles, and that fifty-five twin-engined Boeing transports are being utilized to meet the existing schedules. The ninth anniversary of the first scheduled air mail trip made by United Air Lines over the western division in 1926 was celebrated during the week of April 7. The increased mileage includes a new 4-hour 20-minute regular mail and passenger flight between Chicago and New York. With the new Boeings in service, flying time from Chicago to Los Angeles has been cut one hour on the overnight flight. United is now operating, each day, eight planes east and four west out of Chicago.

Bureau Drafts Development Program

A PROGRAM of development to assist scheduled airlines to further improve safety and reliability of air transportation is now being drafted by the Bureau of Air Commerce.

The program, which includes certain new activities for the Bureau, is the outgrowth of a conference of airline operators who met in the Department of Commerce recently and approved offers of assistance advanced by the Bureau.

Outstanding among the problems to be immediately undertaken by the Bureau of Air Commerce in cooperation with the airlines are matters pertaining to air transport operations at the base of the stratosphere; elimination of ice on aircraft; the installation of a system of radio and lights at airports used by airline planes to provide safe and reliable approaches for landings under conditions of poor visibility; a system of airport and airways traffic control to govern particularly aircraft engaged in instrument flying; and the development of a transport plane carrying less than 10 passengers for use on feeder lines.

Air Transport Day At Newark

AN AIR Transport Day, marking the progress of aviation as a public service from the time of the initial regular air mail service to the wide-spread system operating today, will take place at Newark Metropolitan Airport, May 15th.

Public inspection of the transports of American Airlines, Eastern Airlines, TWA and United Air Lines, launching and christening of the new Douglas amphibion plane of the Standard Oil Company of New Jersey, and educational exhibits to be arranged with the cooperation of the various States, will be among the features.

The committee in charge of the affair includes Mayor M. C. Ellenstein of Newark, Lieut. Richard Aldworth, chairman of the New Jersey State Aviation Commission and manager of Newark Airport, Major E. E. Aldrin, aviation head of the Esso Marketers, representatives of the transport companies, the Railway Express Agency, Radio Station WOR Bamberger Broadcasting Service, American Legion, U. S. Marine Corps Reserve, Army and Navy Reserve, International League of Aviators and various business and civic organizations.

(*Continued on following page*)

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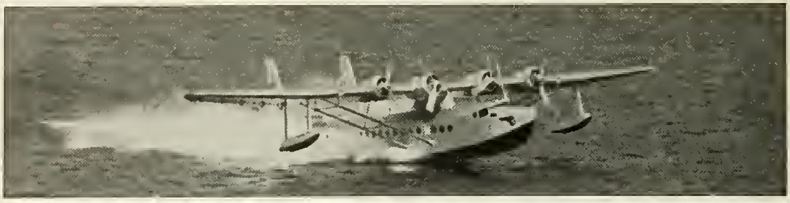


Pan American Sikorsky S-42 which is making experimental flights across the Pacific

(Continued from preceding page)

Airlines Get New Equipment

MEETING THE demand for faster, more efficient and more comfortable air transportation, airline companies added new equipment either to supersede or augment present transport planes.

Braniff Airways is now using Lockheed Vegas between Chcago and Kansas City; tri-motored Fords between Dallas and Brownsville; Stinson Reliants between Waco and Galveston, and Dallas and Amarillo; and a fleet of new 10-passenger Electras have been ordered.

Bowen Air Lines has added a few Vultees to its routes in Texas and subsequently reduced the flying time between the cities it serves by as much as one hour.

National Parks Airways added another Boeing 247 to its fleet on the Salt Lake City-Great Falls route.

1934 Domestic Traffic Lower

CURTAILED OPERATIONS during the air mail cancellation period early in 1934 were to a great extent responsible for the fewer number of passengers in 1934. There were 461,743 passengers who flew with the domestic operators compared with 493,141 the preceding year. This loss also reflected in the total number of passengers carried on domestic and foreign airlines, 561,370 being recorded during 1934 compared with 568,940 for 1933. The foreign lines, however, managed to carry more passengers during the last year than in 1933, the figures being 99,627 and 75,799 respectively.

Miles flown in 1934 were 40,955,396; express poundage reached 2,133,191 and passenger miles flown were 187,858,629. The figures for air express were particularly enlightening showing an increase of about 600,000 pounds in 1934 over 1933 when 1,510,215 pounds were carried. Express poundage on the foreign extensions of domestic lines also increased, recording 1,316,484 pounds, to bring the total air express carried by American airlines to 3,499,675.

Personnel Changes

ROGERS M. COMBS, Jr., and Glenn G. Jury were appointed sales manager and transportation manager, respectively, of American Airlines according to Charles A. Rheinstrom, general traffic manager. Combs was formerly American Airlines' express traffic manager, and is chairman of General Air Express.

Promotion of Clyde S. Fullerton, Transcontinental and Western Air traffic agent at Wichita, to the position of senior traffic representative at Los Angeles was announced recently by H. W. Beck, assistant general traffic agent.

Officials of National Parks Airways announced the appointment of co-pilots Byron Van Cott, Stanley Caville, and A. S. Mooney in addition to Ray Ellinghouse as field manager at Great Falls.

Miss Rosealee Gimple, who has flown some 500,000 miles since United Air Lines employed her two years ago, has been appointed chief stewardess of the Salt Lake Division.

Pacific Service Seen Near

THE UNITED States and the Orient will be connected in the near future by a commercial airways system if the recent round trip flight by Capt. Edwin C. Musick and his crew, serves as an indication of what may be accomplished.

Pan American Airways set the stage for this next most important step in the expansion of our already far-flung airlines, by sending out its Sikorsky S-42 Clipper Ship over the 2400-mile all-water route between Alameda and Honolulu. The ease with which the plane completed its trip to Hawaii and its return indicated the practicability of such a route.

These flights will undoubtedly be extended from Honolulu to the Orient by way of the Midway Islands, where Pan American Airways already has established a base, and Wake, Guam, Manila to Canton. No link in this route is as long as the route to Honolulu, but Capt. Musick said the first flight largely removed the element of chance in the trans-pacific journey.

Airline Celebrates Anniversary

ONE OF the features of the celebration of the eighth anniversary of Pennsylvania Airlines was the announcement that C. Bedell Monro, its president, has been appointed a member of the Air Transport Committee of the Aeronautical Chamber of Commerce of America. Mr. Monro became president of the Pennsylvania company in 1934, and directs the operation of the line from Washington through the cities of Detroit and Milwaukee.

Congratulations!

PENNSYLVANIA AIRLINES

on your eighth anniversary;
best wishes for the future.

SPERRY GYROSCOPE CO.

Congratulations to
PENNSYLVANIA AIRLINES
on your birthday

SCINTILLA

MAGNETO CO., Inc., SIDNEY, N. Y.

Scintilla joins in congratulating Pennsylvania Airlines on their eighth anniversary, and extends its best wishes for much continued success.

GULF REFINING COMPANY

joins in congratulating

PENNSYLVANIA AIRLINES

on their eighth anniversary and
extends its best wishes for
P. A. L.'s continued success.

Our Congratulations and Best Wishes

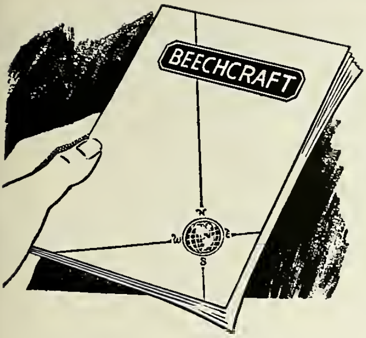
PENNSYLVANIA AIRLINES

on your eighth anniversary

●

THE TEXAS COMPANY

CLAIMED Performance
vs
GUARANTEED Performance



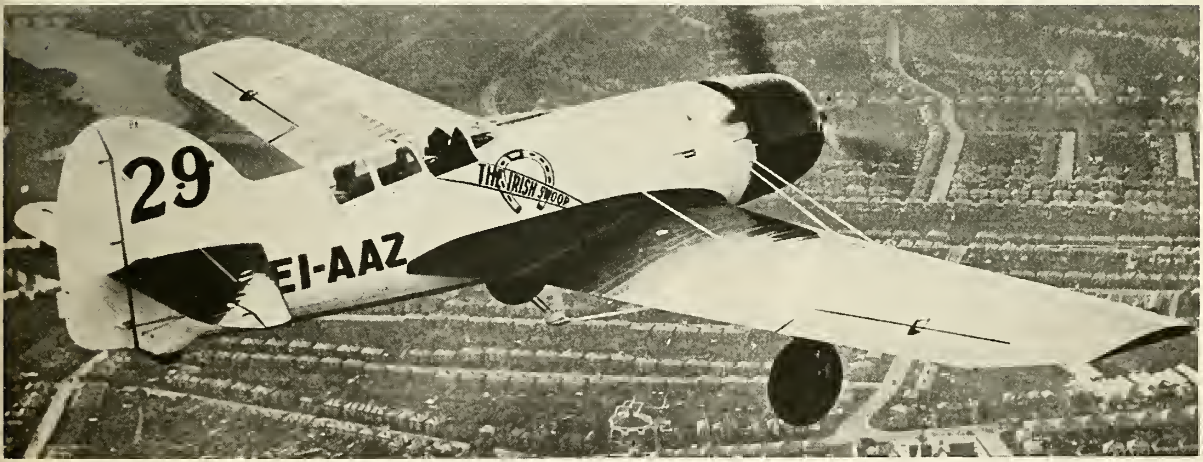
IF YOU WANT A COPY OF THIS NEW BEECHCRAFT CATALOG, PLEASE SEND YOUR REQUEST ON YOUR LETTERHEAD.

NOW that all the 1935 models have been announced, compare Beechcraft's ***guaranteed*** performance with other performance ***claims.*** « « ***Beechcraft is still 20 to 30 miles in the lead!*** « « It is ***not*** enough to give the r.p.m. at ***cruising speed.*** Beechcraft states clearly the actual horsepower used, and ***guarantees*** performance on this basis. Speeds are arrived at over a certified five mile course. « « In addition to its high speed performance, Beechcraft retractable landing gear gives the added safety of a 4-to-1 ratio—top speed, 175 m.p.h.; landing speed, 45 m.p.h. And its operating cost is about the same as the cost of driving an automobile.

BEECHCRAFT PERFORMANCE (Guaranteed)

Engine	Prop.	Cruising h.p.	Cruising Speeds (m.p.h.) and Altitude
Jacobs L-4	Metal	175	155 S. L., 162 at 5000, 166 at 7200
Wright R760E-1	Metal	210	165 S. L., 173 at 5000, 177 at 7200

BEECHCRAFT › › › Wichita, Kansas



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AT THE AIRPORTS

New Organizations

CAPITOL AIRPORT, INC., has been chartered to operate an airport. Officers of the corporation which has its home office in Bladensburg, Md., are Edward W. Stitt, Robert W. McCullough and Robert Martin. Capitalization has been placed at $20,000.

Offices have been opened in the Rapid Airlines hangar at the Omaha, Neb., municipal airport by the recently incorporated Nelson Flying Service.

Recent Dedications

A THREE-DAY centennial celebration at Aiken, S. C., got under way April 4 with the official opening of the new municipal airport, two miles from the city. Several Army planes attended, and stunt and formation flying featured the flying program.

At Wichita, Kans., more than 15,000 persons watched the dedication of the new $140,000 administration building on the municipal airport there. A stunt program, featuring Roy Hunt, was a feature of the day's activities.

Allegheny Port Busier

THE ANNUAL report submitted by Halsey R. Bazley, manager of the Pittsburgh Allegheny County Airport indicates increased activity during 1934.

Included in the improvements made, was the installation of a two-way radio. Transport arrivals and departures numbered 5,874; passengers departing numbered 11,102 while 10,787 arrived at the field in planes operated by three of the companies using the facilities there.

During the year, the Air Corps Reserve base formerly at Rodgers Field was moved to the County Airport and all Army operations transferred to this base; also it is expected that the service base now at Burgess Field, Uniontown, will be transferred to Pittsburgh.

The airport management has also remodeled a farm house near the field which will be open to pilots and which will afford every convenience including lounge rooms, sleeping quarters and restaurant. Known as the Flying Club, the building is only a short distance from the airport's main entrance and has telephone connections with the administration building so that weather and other information is available in short notice.

Personnel Changes

WALTER B. McALISTER has become vice-president and sales manager of Edward F. Booth, Inc., Dallas agent for Stinson airplanes.

J. L. Schroeder has taken over the management of the Main Street airport, Houston, Texas and is now supervising improvements, on the field. Repair and servicing facilities are available and the flying school there is under the direction of R. G. Buswell.

Under a new set up William H. Turner has been named president of Commercial Aircraft Co., Portland, Ore., and he will be assisted by Jack Clemence and Vern St. John.

Eau Claire Airways, Inc., has been purchased by A. S. Ward who will continue the functions of the company as an aircraft sales, flying instruction, charter and private flight institution. At present he has a Travel Air and a Curtiss-Wright Junior and plans to purchase additional planes and equipment.

The town of Rangeley, Me., has leased its seaplane base to Leon H. Tanguay & Co., commercial aircraft operators of Rockland, for one year. The company began operations the first of this month and plans to have the airport available for landings about the middle of May. The airport has two 2000-foot runways and good approaches.

Clover Field, Santa Monica, Calif., was leased for a period of three years by Howard Batt who will be associated with Howard F. Murchie in an effort to make the field a sportsman pilots' project. The adjacent municipal golf course, beach clubs and hotels, together with the availability of weather reports, storage and service facilities make the field an ideal location for sportsman and private pilots.

Gulfport, Miss., has a new airport manager in the person of H. W. McLaurin who succeeded Walter Hostettler who resigned to join Eastern Airlines, and Eddie Schneider has become manager of the Jersey City, N. J., airport where plans are under way for extensive improvements. Student instruction, fuel and oil and a Rearwin sales agency will be available

Dycer Flying Service, Inc., Los Angeles, Calif., has employed J. Grant McDonald as pilot and instructor.

Caribou Now Airport of Entry

THE MUNICIPAL Airport at Caribou, Maine, has been redesignated as an airport of entry for the landing of aircraft from foreign countries for a period of one year from October 31, 1934.

Airport Improvements

ONE OF the last acts of the Maine Legislature before adjourning was to pass a bill authorizing the purchase of land to expand and improve the Augusta state airport. Three runways have already been built and a two-story administration building is under construction.

Two acres of land have been deeded by H. R. Ruel to the city of Portsmouth, Ohio for a hangar at Rock Haven airport, and Felts Field, Spokane, is to have a new $120,000 hangar in the near future. It will measure 120 × 200 feet and its both ends will open completely to allow operations by the largest craft.

Work has been resumed on the Utica muncipal airport and FERA workers are trenching, leveling and enlarging the field under the direction of Edward Blanch.

Dan Bradera has just completed a field 2 miles from Indianola, Miss., which has T shaped runways extending 1,640 and 1,250 feet, a hangar now under construction, natural drainage and no obstructions. As manager of the field Bradera plans to organize a flying club and purchase a light plane for training purposes, and for building up students' time.

2,280 Airports In Use

ON DECEMBER 1, 1934 there were 2,280 airports and landing fields operating in the United States, according to the Bureau of Air Commerce of the Department of Commerce. Of these, 653 are equipped with some form of night lighting installation.

There were more municipally-owned airports than any other, 697; commercial airports numbered 576 and marked auxiliary fields totaled 568. There were 256 intermediate fields, 58 Army, 48 private, 33 state-operated, 24 Navy, and 20 miscellaneous airports operating at the time of this report. In addition, the Bureau was advised that 26 airports were in the proposed stage.

Lindbergh Field Gets A-1-A Rating

LINDBERGH FIELD, San Diego, Calif., has been awarded an A-1-A rating by the Bureau of Air Commerce, according to Thomas A. Bomar, aviation secretary of the San Diego Chamber of Commerce.

The field, which is 1½ miles from the City's downtown section, will be further improved by the San Diego harbor department which plans to spend $400,000 for the installation of seaplane facilities and the completion of an additional 80 acres between the airport and the U.S. Marine base.

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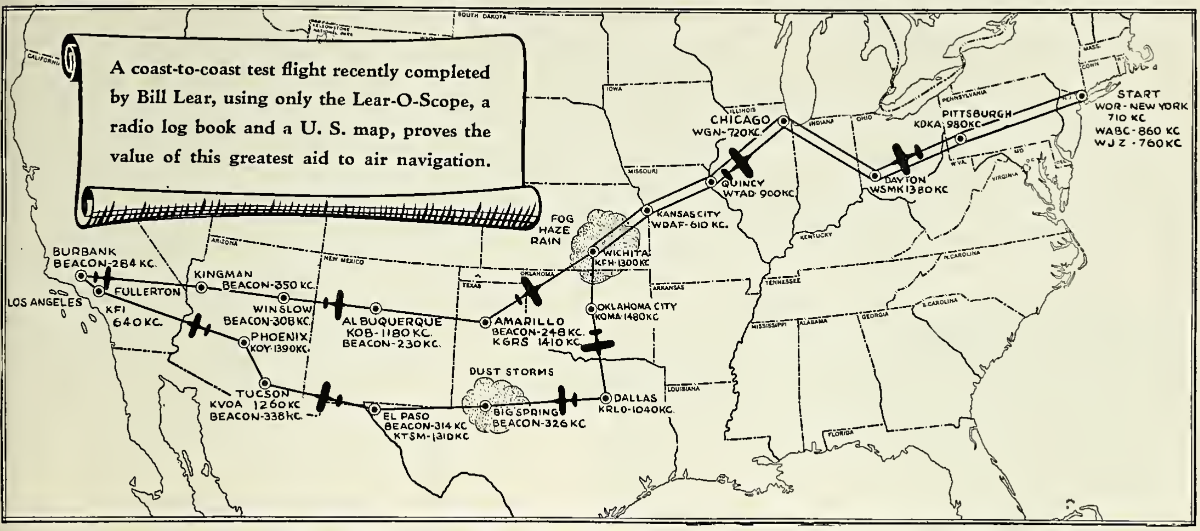
7000 Miles *prove* *LEAR-O-SCOPE


A coast-to-coast test flight recently completed by Bill Lear, using only the Lear-O-Scope, a radio log book and a U. S. map, proves the value of this greatest aid to air navigation.

"LEAR-O-SCOPE LEADS LEAR TO THE COAST AND RETURN"

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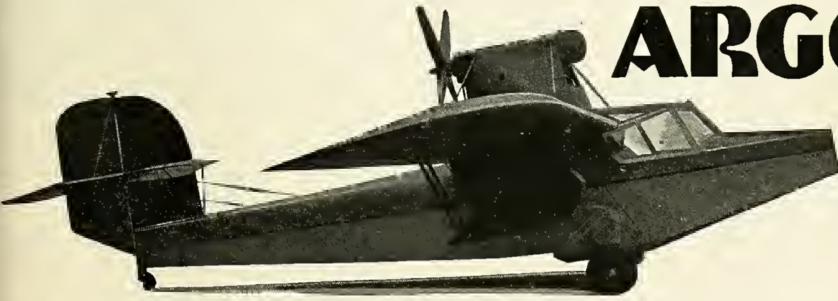

SPECIFICATIONS

3-place cabin flying-boat type, pusher Amphibian (Menasco C4 PIRATE Engine, 125 H.P.).

Span 35 ft. 4 in.; length 26 ft.; height overall 8 ft. 2 in.

Gross wt., fully loaded, 1870 lbs.
Gasoline, 40 gallons ..... 240 lbs.
Payload (in place of 2 passengers plus 100 lbs. baggage) 440 lbs.
Maximum speed .... 120 MPH
Cruising speed .... 104 MPH
Landing speed .... 40 MPH
Rate of climb. 1000 ft. per min.
Cruising range .... 500 miles

Standard equipment includes starter, cabin heater, brakes, anchor, navigation lights; wobble pump, engine-driven fuel pump. Instruments: airspeed, compass, tachometer, fuel gauge, ammeter, voltmeter, altimeter, oil pressure, oil temperature, pitch and bank indicator, switch, fuel pressure.

ARGONAUT brings anew the thrill of exploration! New camps and trails on lake and bay are brought close to home! The Argonaut Pirate opens up vast new advantages and new enjoyments in flying, at a price as outstanding as the ship. An ***Amphibian,*** the outstanding ship for business or pleasure.

Three passengers sit side-by-side in the *quiet* cabin, heated and ventilated for all-year comfort. A hundred other features win instant approval of seasoned pilots. The Argonaut is sturdy, accessible, economical—priced under $5,000 with complete equipment. Write today for the Pirate folder with full details, pictures, etc.

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ACTIVITY AT THE SCHOOLS

Jones Students Form Society

SENIOR ENGINEERING students of the Casey Jones School of Aeronautics, have formed an Aeronautical Engineering Society to discuss topics of interest in the field of airplane engineering; to invite authoritative speakers to address the students as a whole; to promote social activities among the members; and to form a binding link with the school and with each other after their graduation.

Officers are: Jack Farr, president; Robert B. MacDougall, vice-president; William Koser, secretary; and Ernest Arens, treasurer.

Personnel Changes

LARGE INCREASES in student enrollments at various schools throughout the country has necessitated the addition of instructors.

W. Winfield Scott has been added to the instructor staff of the Grand Central Flying School at Grand Central Air Terminal in Glendale, Calif., according to Joe Plosser, operator. Scott is the third instructor on the staff.

Paul Wilcox has been appointed flight instructor at the Ryan Shool of Aeronautics, and Captain Al Williams has joined the instructional staff of Roosevelt Aviation School. As a member of the faculty, Captain Williams will advise with the staff as to curriculum, training methods, lecture in both the flying and mechanics division, and personally assist in the advanced stages of flying instruction.

24 Students Graduated from Boeing

DIPLOMAS WERE presented to 24 members of the twentieth graduating class of the Boeing School of Aeronautics, Oakland municipal airport, during ceremonies at the completion of the winter quarter. Chester Rowell, editor of the San Francisco *Chronicle,* was guest speaker at the exercises, and A. F. Bonnalie, director of technical instruction, presented the certificates of graduation.

William B. Stout, president of the American Society of Automotive Engineers and the Stout Engineering Laboratories, has offered an annual trophy to the Boeing student who presents the most original, practical design for an airplane.

New Courses Offered

VARIOUS PHASES of aviation are included in the ground school courses offered by Tilden High School, Chicago. The course is general and elementary being designed to familiarize the student with the opportunities in aviation, particularly in the transport field.

The summer session at the University of Michigan, Ann Arbor, will include a number of courses applicable to aeronautics as Advanced Fluid Dynamics, and Vibration Problems in Engineering. Courses begin June 24 and continue until August 16.

Air Schools Day At Fair

RECOGNIZING THE increasing number of student pilots throughout the United States who are training under the supervision of approved flying schools, officials of the California Pacific International Exposition at San Diego, in conjunction with the Ryan School of Aeronautics, have designated August 25 as America's Schools of Aviation Day.

Invitations will be extended to flying schools throughout the United States to participate in this event by representation through student flights from the individual school airports to San Diego. Flights will be scheduled to arrive at Lindbergh Field, San Diego on or before the morning of August 25, and in the afternoon of that same day, trophies will be awarded on the Exposition grounds to the winners of specified events.

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May, 1935.

My 1935 Catalogue of Aviation Supplies and Materials consists of 44 pages 9" x 12", just about half again as large as the catalogue I put out last year. While the catalogue is half again as big, many prices are still lower than last year, in fact it's cram full of bargains.

Unfortunately for me, and for you, it's costing me as near as I can figure 25¢ or 30¢ apiece to print this new catalogue, address it and deliver it to you. I say it's unfortunate, because I would like very much to send one of the 1935 catalogues to every one interested in aviation but I can hardly afford to do this because there are now 37.642 fellows like you who are interested in the stuff I sell.

In order to keep my prices down, and I am still trying hard to do that in the 1935 catalogue, it is necessary to watch expenditures very closely. If I didn't, I would have to charge higher prices in order to make up for the cost of sending catalogues to people who didn't want them. Therefore, I am going to make you a sporting proposition. If you will send me a dime, being sure to write your name and present address on the coupon below, I will add twenty cents of my own money to it and send you a new catalogue right away. Better than that, I will see that you get the latest bargain bulletins during 1935 as fast as they are printed and refund your dime with your first purchase.

I hope that you will be as tickled with the new two color catalogue as I am and I know that you will find the prices very low. If I don't hear from you I will understand that you are not interested but if you want the catalogue don't delay a moment but send the dime right away today because it will help me to tell the printer exactly how many copies of the catalogue he should print and you will receive a copy promptly without having to wait for a reprint in case the first edition is exhausted before your reply is received.

Perhaps you remember how Will Rogers told a guy who said he didn't like his programs that he had no sympathy with anyone too lazy to turn the dial:--well, if you are willing to pay high prices for aircraft materials because you're too lazy to send me your address and a dime when I provide a coupon to make it extra easy for you, you don't deserve any sympathy either.

Yours very truly,

Karl Ort.

KARL ORT, 624 W. Poplar St., York, Pa.
Dear Ort: Send me your new 1935 catalogue right away. Here's your thin dime. I sure want it back when I send you my first order.

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PRIVATE FLYING AND CLUB NEWS

Club Officers Elected

NEWLY ELECTED officers are now guiding the destinies of at least three more clubs in the United States.

New quarters have been opened by the Portland, Ore., Aero Club in the Liebes Building. The business committee of the club is now composed of Dr. R. R. Staub, Harry K. Coffey, Cecil J. Pounder, Major Howard C. French, Tex Rankin, Alice Pashborg, Earl C. Bronaugh, Jr., Allan A. Bynon and William Lundin.

At the annual election of officers for 1935 held by the Indianapolis Aero Club, L. Schwitzer was unanimously elected president. Other officers are E. W. Springer, vice-president; Dr. W. B. Currie, secretary; S. McKittrick, treasurer. At present the club's roster includes sixty-five members.

During the annual meeting of the Duluth Aviation Club, Inc., of Duluth, Minn., Dr. M. R. Herrmann was elected president; Dean W. Tresise and Norman E. Nelson, vice-president; H. A. Lindberg, secretary; F. W. Gruba, treasurer; and Williard B. Matter, Earl H. Anderson, A. J. Pfaender and Earl Olson, directors.

N. Y. Commission Continued

GOVERNOR H. H. LEHMAN signed a bill extending the life of the New York State Aviation Commission for another year, and appropriating $15,000 to carry on the work done by Senator A. Spencer Feld, its chairman, and his board. The commission has been functioning since 1930 when it was organized to study the requirements of aviation, and to install a state system of weather information.

College Club Group Formed

WITH MORE than seventy delegates present from twenty-five colleges and universities, the first National Intercollegiate Flying Conference opened recently at the Lee House in Washington.

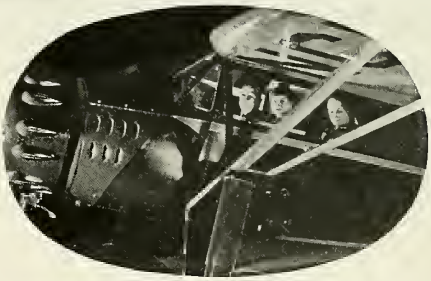
Two business sessions completed the formation of the club, and a program of action was mapped out. William D. Stroheimeier, of the Amherst College Flying Club was elected president; Raymond H. Gaver of Purdue, vice-president; and Earl Bennettsen of the University of Minnesota Flying Club, was elected secretary-treasurer. Grover Loening was unanimously elected honorary president.

The club's program includes numerous objectives. Its chief interest is the affiliation of all existing college flying clubs with it. Secondly, it plans to increase college flying activity, and with an extensive campaign already mapped out, its ultimate goal is the formation of a flying club on every campus in the United States. The club will also sponsor the National Intercollegiate Air Meet scheduled, tentatively, for June 22 at the new Purdue University Airport at Lafayette, Ind.

New Clubs Formed

LEWIS W. KING, of American Airlines, was elected president of the Chicago Air Transport Club, which is a reorganization of the former Chicago Air Traffic Club. John Graves, Eastern Airlines, is vice-president; Charles Hubbard, United Air Lines, secretary-treasurer. The club meets the second Monday of each month and its membership is limited to persons interested in air travel.

A petition for revival of its charter was filed by the American Flying Club, of Baltimore, Md., and at a reorganization meeting, it was decided to rename it the Maryland Flying Club.



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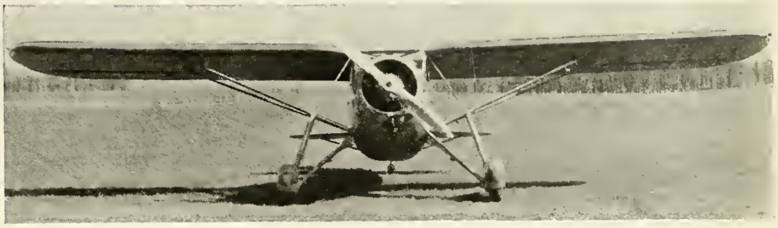

THE FAIRCHILD "24" was designed for the private flier . . . the man who desires an airplane for personal transportation. In this field it has achieved a wide popularity . . . (1) because its perfect aerodynamic characteristics enable a comparative novice to fly just as safely as the veteran expert; (2) because it combines a 747 pound payload including the pilot with a short take-off, 120 M.P.H. cruising, 19,000 feet service ceiling and an amazingly slow landing speed; (3) because its gas consumption gives you 12.63 miles per gallon . . . a cost of only 2/3 of a cent per-mile per-person.

Add to this the greater economy of maintenance resulting from such exclusive Fairchild features as ball-bearing controls, exceptionally wide landing gear with 8-inch oleo travel, and complete corrosion-proofing through cadmium plating, baked enameling, and anodizing . . . and you have a combination of features which places the Fairchild "24" far in the lead as the ideal personal airplane of today. Please write for details or see your nearest Fairchild Dealer.

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THE AIR SERVICES

Navy Plans Mass Flight

A MASSED aerial circumnavigation of the Eastern Pacific will be an accomplished fact if plans of the Navy for the Fleet maneuvers this spring fully materialize.

Tentative plans call for an armada of multi-motored planes to embark on an 11,000-mile trip, 2,000 miles of which will be in formation. The planes will first fly northward from San Diego, and within two weeks cover the American mainland to the Canadian border, fly to the Alaskan Coast, from there across the gulf of Alaska to Kodiak Island, and then on to Dutch Harbor in the Aleutian Islands.

From Dutch Harbor the planes will proceed to Adak Island where they will be overhauled for the 2,000-mile flight to Midway Island. After reaching Honolulu, the planes will return to the mainland.

Fisher To Command Maxwell

COL. ARTHUR G. FISHER, now on duty in the office of Chief of the Air Corps, on July 1 assumes command of the post and Tactical School at Maxwell Field, Montgomery, Alabama, succeeding Col. John F. Curry, who is completing a four-year term in command of the field. Col. Curry will report for duty as a student in the Army War College for the term beginning in the fall.

Air Corps Board to Convene

SEVERAL MEMBERS of the recently reorganized Air Corps Board, of which Col. W. O. Ryan, of Maxwell Field, is president, have been ordered to the Alabama post. Lieut. Col. Jacob H. Rudolph will become director of the board, and other members will include Maj. Leslie MacDill and Capt. Samuel C. Skemp.

The Air Corps Board is a permanent group of officers whose duty it is to study ways and means of improving the efficiency of the Air Corps, both technically and in personnel.

Army Buys 15 Bombers

A CONTRACT for 15 bombing planes was awarded by the War Department to the Glenn L. Martin Co., augmenting previous contracts for 81 bombers. The amount of the latest award is $652,279.

The War Department estimates the Army Air Corps will have 1367 planes by next June, of which 146 will be bombers. Despite accelerated activity in purchasing equipment, the Department has 92 fewer planes than it had last year.

Marine Reserves Inspected

SQUADRON VO-6-MR held a drill and inspection at the Naval Reserve Aviation Base, Floyd Bennett Field, Brooklyn, N. Y., with several members of the House Naval Affairs Committee in the inspecting party. Brigadier General Seth Williams, U. S. M. C. headed a party of Marine officers.

The unit consists of 17 officers and 60 enlisted men, with First Lieut. John T. Salmon as inspector-instructor. A program of dive bombing, aerial gunnery, and formation flying featured the program.

Butler Now Vice Admiral

AVIATION'S INCREASED importance to the Navy was recognized when Rear Admiral Henry V. Butler was appointed vice admiral as commander of the fleet's aircraft battle force.

Commander of 520 planes, Admiral Butler is now a member of the "Big Five" of the fleet high command. The planes are stationed on the four aircraft carriers.

Army To Buy More Link Trainers

REPORTS FROM various activities indicate that the instrument flying Link-type Trainers, which were procured for the training of Air Corps personnel in the use of blind flying instruments, have proved very satisfactory and reduce the amount of training in the blind flying airplane approximately two hours.

Regular periods of training on this device are being required at the activities where they are now located. The Office, Chief of Air Corps, recently issued instructions that additional trainers be procured as soon as funds become available. These will be allocated to Air Corps stations, as follows: seven to the Air Corps Training Center, three to Maxwell Field, two each to Barksdale and Bolling Fields, and one each to Clark, Nichols, Luke, Wheeler, Albrook, France, Hamilton, Crissy, Wright, Selfridge, Scott, and Bolling Fields, Fort Leavenworth and the Office of the Chief of the Air Corps.

G.H.Q. Now Functioning

WITH THE removal of the General Headquarters Air Force to Langley Field under the command of Brig. Gen. Frank M. Andrews, three separate wings have been placed under his direction, and Brig. Gen. B. D. Foulois has taken control, as Chief of the Air Corps, of the training center at Randolph Field; of the repair depots; and of a part of procurement plans.

The eastern group of the G.H.Q., housed at Langley is commanded by Brig. Gen. H. Conger Pratt; the western group is at March Field, California under the command of Brig. Gen. Henry H. Arnold; and the third group is at Galveston, directed by Lieut. Col. G. C. Brandt.

Navy Pilots to Get Transport Rating

UNDER A recent ruling by the Bureau of Air Commerce all qualified Navy pilots will be granted transport pilot licenses without the customary flight tests and written examinations if they are recommended by the Bureau of Aeronautics. Only men who have had more than a year's flying service after completing their training are to be put on the approved list by the Navy.

San Diego Base Improved

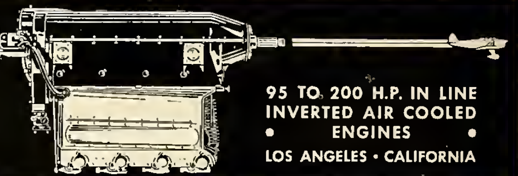
AN EXTENSIVE program of alteration and rehabilitation has been undertaken at the Bachelor Officers' quarters at the North Island naval air station in San Diego, Calif.

The entire south wall was practically rebuilt; floors were refurnished; rooms painted and varnished; and the interior redecorated.

Lakehurst Lone Airship Base

PLANS HAVE been completed for concentrating all remaining Navy dirigible activities at Lakehurst, N. J., and the dirigible base at Sunnyvale, Calif., is to be converted into an airplane training center pending decision on the future of airships. The only lighter-than-air craft now at Sunnyvale is a blimp. The decommissioned Los Angeles and a training dirigible are at Lakehurst.

Officials said the number of persons working at Sunnyvale would not be affected because of training facilities to be established for carrier airplane squadrons.



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Gives You The **4** POINTS
of PRACTICAL FLYING

★**SECURITY** because of the dependable motor and sturdy construction.
★**ECONOMY** beyond a doubt since it uses only three gallons of gasoline and ¼ pint of oil per hour cruising.
★**COMFORT** for both pilot and passenger . . . . full cushioned seats and plenty of leg room.
★**MANEUVERABILITY**, which has been one of the outstanding features of the Aeronca, still inherent in this new model.

New descriptive folder, "4 Point Flying" will be sent on request.

AERONAUTICAL CORPORATION OF AMERICA
Lunken Airport Cincinnati, Ohio

AERONCA RESEARCH AND IMPROVEMENT HAVE NEVER STOOD STILL

MACWHYTE
TIE
RODS

⬬ STREAMLINE ■ SQUARE
● ROUND

● Macwhyte makes a complete line of highest quality tie rods—streamline for external bracing, square and round for internal bracing—together with standard and safe lock terminals. Standard equipment on most of America's aircraft.

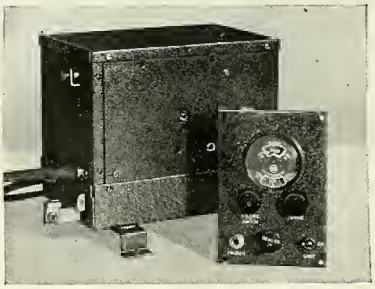
Macwhyte Company
Kenosha, Wisconsin

AVIATION RADIO RCA

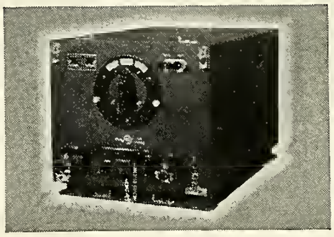
LOW *in* COST
but little giants for
PERFORMANCE

MODELS AVR-7 and AVR-7A AIRCRAFT RECEIVERS

Two rugged, compact, lightweight receivers to delight the private or commercial pilot's heart. Model AVR-7 combines the beacon and entertainment bands. Model AVR-7A the beacon and communication bands. Both are 4-tube superheterodynes with remote control requiring no other power source than your aircraft battery (6 or 12 volts).



MODEL AVT-3A AIRCRAFT TRANSMITTER



Climb aboard, all you critical buyers who have been holding out for a lightweight, compact, high-quality transmitter at low cost. The AVT-3A makes the grade. CW and MCW telegraph. 100% modulated telephony. 20 watts output. Operates on any three pre-specified frequencies (selective in flight) between 2,000 and 6,500 K.C. Entire equipment, including dynamotor power supply, contained in a single package. Overall weight, 38 lbs. Rugged construction.

NON-OBSOLESCENCE IS THE FEATURE OF RCA AIRPORT EQUIPMENT

MODEL AVT-1A—Airport Radio Traffic Control Transmitter, typical of RCA's complete line of high-quality, low-cost equipment. Not obsoleted by later need for expanded service. Easily adaptable to radiobeacon and speech amplifier service.

DROP IN AT AVIATION RADIO HEADQUARTERS

You will be warmly welcomed at RCA's new Aviation Radio Headquarters at Central Airport, Camden, N. J. Here you can actually see and operate every piece of aviation radio equipment in the RCA line. Your ship will be taken care of. Drop in and see us.

For further details, demonstration or purchase, address:

AVIATION RADIO SECTION
RCA MANUFACTURING CO., INC.
Camden New Jersey

THE INDUSTRY IN GENERAL

Aircraft Show Planned in July

THE INDUSTRY'S first major aircraft show in three years is to be held at the Detroit City Airport from July 20 to 28.

Built principally around the sportsman pilot and business executive airplane user and buyer, the show will be staged by Ray Cooper who has resigned from the NAA and returned to Detroit to start this undertaking. Sanctioned by the Aeronautical Chamber of Commerce as a Class C show, the event is being sponsored by the Aeronautical Activities Association of Michigan. Cooperating will be the Detroit Board of Commerce, The Adcraft Club of Detroit, the Detroit Convention and Tourist Bureau, and the Department of Public Works of the City of Detroit. Present indications are that the Sportsman Pilots Association will participate.

Class C shows are intended for dealers and distributors, but manufacturers may participate if they so desire.

Bureau Contracts For Private Craft

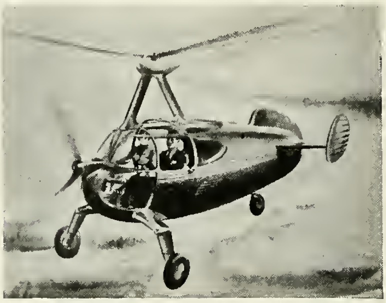
STILL ENDEAVORING to find a cheap, practical and safe airplane for the private market, the Bureau of Air Commerce placed two more contracts with manufacturers for new-type craft.

One order has been awarded to Fahlin Manufacturing Co., Marshall, Mo., for a two-place, side-by-side inclosed cabin monoplane powered by a Plymouth automobile engine; and another contract has been placed with the Autogiro Company of America for a two-place cabin autogiro incorporating several new features. This plane will be designed for operation on highways after landing or prior to take-off, for storage in small enclosures, and to "jump off" from any field.

The Fahlin plane has been completed and is now undergoing test flights. In these flights it showed a top speed of 120 m.p.h., a cruising speed of 104 m.p.h., and a landing speed of 42 m.p.h. It has an empty weight of 1075 lbs., a useful load of 536 lbs., and a gross weight of 1611 lbs.

In addition, the Bureau has sanctioned the Fairchild Aircraft Corp., to modify an airplane incorporating new type controls recently developed. These controls are expected to provide better control in the air and in landing by elimination of the rudders, and utilization of new-type flaps in the leading edge of the airfoil, and a combination of slot and aileron, in the middle of the wing at the trailing edge. An article by Prof. Alexander Klemin on two-control operation appeared in the April, 1935, issue of AERO DIGEST.

The Bureau also awarded a contract to the Continental Motors Corp., for a 90 horsepower, six-cylinder, radial, air-cooled engine for use in connection with its private plane program. The engine will be 20 inches in diameter, and will operate on the two stroke cycle. The Department's specifications require that the weight of the engine will be not over two pounds per horsepower, including the starter and generator.


Artist's conception of new-type Autogiro

Martin Boat Undergoes More Testing

PENDING ADDITIONAL work on soundproofing, engine developments and strengthening of the sea wings, Clipper Ship No. 7, constructed by the Glenn L. Martin Company for Pan American Airways, will be given her next tests May 10. From May 12 to 15, inspectors of the Bureau of Air Commerce will be at the Baltimore plant to conduct approved type certificate tests. It is expected that flights to Miami will be made by the middle of May. Delivery of the Clipper to Pan American Airways is scheduled for June.

Consolidated to Move to San Diego

ANNOUNCEMENT WAS made April 10 that Consolidated Aircraft Corp., is building a new factory in San Diego, Calif., and will move there about August 1, to eliminate the difficulty in transporting large flying boats by rail from its present plant in Buffalo, N. Y.

Maj. Reuben H. Fleet, president of the company, said that the city of San Diego has agreed to provide a day and night field, and will construct a flying boat base.

In peak times the Consolidated company employs 1250 workers in its leased Buffalo plant, with a weekly payroll of $50,000. At present, the Buffalo plant is constructing a number of flying boats for the Navy, but this contract is expected to be filled within a few weeks. It also has a contract for 50 Army planes, but most of these will be built on the West coast.

Errata

FIRST COPIES of the April issue of AERO DIGEST contain errors which were corrected before final copies came off the press. The following corrections should be noted:

The Rearwin Sportster, listed as having ATC 469, has its approval pending. (Page 105)

Officers of the Pitcairn Autogiro Co., are Harold F. Pitcairn, president; Raymond Pitcairn, vice-president; K. C. Acton, secretary; and Paul Hovgard, chief engineer. James G. Ray and Agnew E. Larsen are vice-president and vice-president and chief engineer respectively of the Autogiro Company of America, which is also headed by Mr. Pitcairn. (Page 90)

Items listed as standard equipment on the Aeronca C-3 are optional with the purchaser at additional cost. (Page 48)

The illustration accompanying the description and drawing of the Kinner Sportster (Page 78) is the Security Airster and that accompanying the latter (Page 94) is the Kinner Sportster.

The Consolidated P2Y-1J Flying Boat, was improperly captioned the North American Observation OJ-2. (Page 128)

The two-place Fahlin monoplane, powered by a Plymouth automobile engine, as produced for the Bureau of Air Commerce

Permite Products in New Engine

AFTER FIVE years use as standard equipment in the Aeronca engine, Permite Products are being used this year on the new Aeronca E-113-B engine, according to Aluminum Industries, Inc., Cincinnati, makers of Permite products.

The redesigned Aeronca piston is made of *Permite* aluminum alloy, cast in a permanent steel mold to insure elimination of sand holes. The piston skirt has been lengthened to reduce tumbling of the piston in the cylinder, and Permite's full-floating piston pin made of SAE 4615 steel is now used. The hole is tapered for high strength and low weight.

Aeronca uses Permite Diachrome Valves which are of the full tulip-head type made of heat-resisting and wear-resisting steels, fused into a composite structure at a point shielded by the valve guide. They are interchangeable.

Permits also supplies the torque pins and aluminum hinge bearings used on the new Aeronca.

Personnel Changes

THREE AERONAUTICAL engineers, Walter T. Brownell, Elisha N. Fales and Irving R. Metcalf, were appointed to the recently created Development Section of the Bureau of Air Commerce. Brownell will investigate and flight-test new aircraft and aircraft engines; Fales will test and pass on new designs from an aerodynamic standpoint and will work on new controls and similar problems; and Metcalf will be engaged in problems pertaining to aircraft materials, aircraft production methods, and the development of instruments.

Howard S. Welch has been appointed chief of the Automotive-Aeronautics Trade Division of the Bureau of Foreign and Domestic Commerce. The Division's function is to disseminate to American firms current information on trade conditions abroad, and to generally cooperate in building up foreign markets for the products of the two industries.

With the promotion of Guy W. Vaughan to the presidency of the Curtiss-Wright Corp. two executives of the Wright Aeronautical Corp. have been elevated to higher positions. George Chapline is now vice-president in charge of sales, and Myron B. Gordon is vice-president and general manager. Although Mr. Vaughan continues as president of the Wright company, Mr. Gordon will be the active executive manager.

Officers and directors of the Consolidated Aircraft Corp. were re-elected at the annual meeting of stockholders. Officers re-elected are Reuben H. Fleet, president; Lawrence D. Bell, vice-president and general manager; Ray P. Whitman, vice-president and assistant general manager; George Newman, vice-president; and Raymond S. Madison, secretary-treasurer.

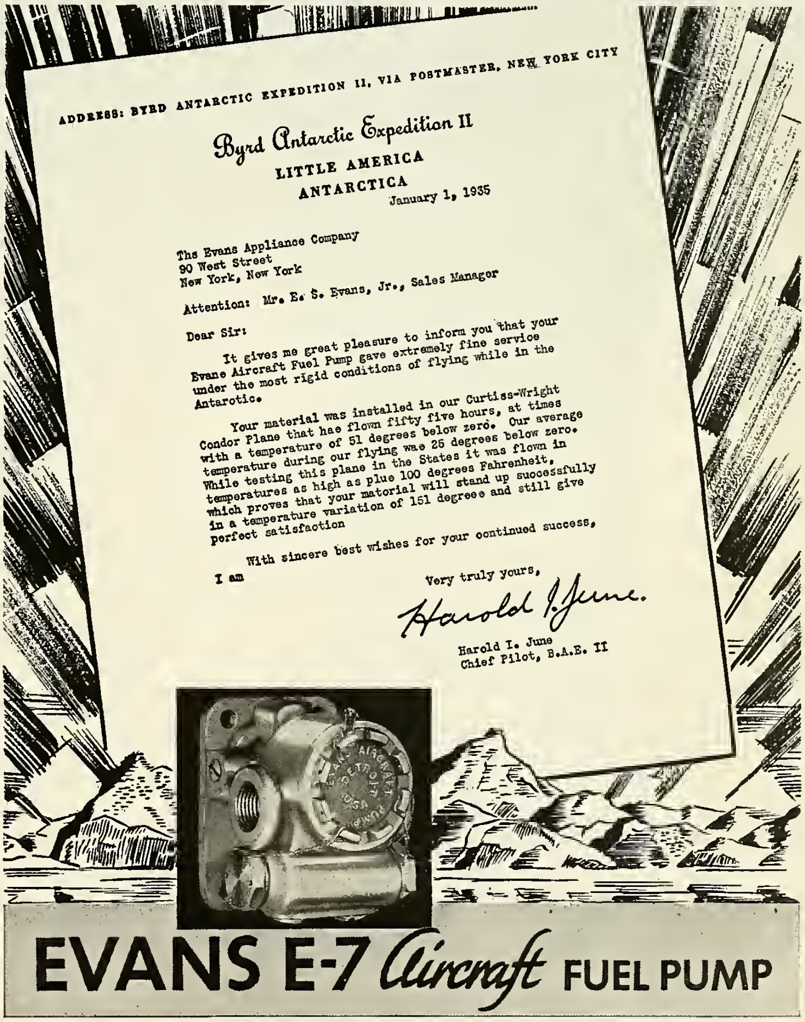
Officers of the Lockheed Aircraft Corp. also were re-elected. They are Robert E. Gross, chairman of the board, president and treasurer; Hall L. Hibbard, vice-president and chief engineer; Carl B. Squier, vice-president in charge of sales; and Cyril Chappellet, secretary.

Ray W. Brown, aeronautic tire sales manager of the General Tire and Rubber Co., has been appointed chairman of the ATC contest committee of the NAA, and L. Edwin Gill, formerly vice-president in charge of traffic for Eastern Air Lines is now in charge of the aviation department of Churchill-Hall, Inc., New York advertising agency.

Large Fuel and Oil Contracts Signed

AMERICAN AIRLINES contracted for enough fuel and oil to meet a year's requirements when 125,000 gallons of oil and 4,300,000 gallons of fuel were purchased.

Sinclair Refining Co., for the third successive year was awarded the oil contract, while the fuel contracts were divided among Shell Petroleum Corp., the Standard Oil Company of Ohio, and the Pasotex Petroleum Corp., of Texas. Additional orders are to be signed in the near future to bring the total fuel purchased to 7,000,000 gallons.


EVANS AIRCRAFT DETROIT USA PUMP
EVANS E-7 Aircraft FUEL PUMP

ADDRESS: BYRD ANTARCTIC EXPEDITION II, VIA POSTMASTER, NEW YORK CITY

Byrd Antarctic Expedition II
LITTLE AMERICA
ANTARCTICA

January 1, 1935

The Evans Appliance Company
90 West Street
New York, New York

Attention: Mr. E. S. Evans, Jr., Sales Manager

Dear Sir:

It gives me great pleasure to inform you that your Evans Aircraft Fuel Pump gave extremely fine service under the most rigid conditions of flying while in the Antarctic.

Your material was installed in our Curtiss-Wright Condor Plane that has flown fifty five hours, at times with a temperature of 51 degrees below zero. Our average temperature during our flying was 25 degrees below zero. While testing this plane in the States it was flown in temperatures as high as plus 100 degrees Fahrenheit, which proves that your material will stand up successfully in a temperature variation of 151 degrees and still give perfect satisfaction

With sincere best wishes for your continued success,

I am

Very truly yours,

Harold I. June

Harold I. June
Chief Pilot, B.A.E. II

EVANS AIRCRAFT FUEL PUMPS assure a higher degree of continuous correct gas pressure on the carburetor regardless of air conditions, temperature, or flying position. With constant fuel pressure, motor efficiency is increased and an unvarying R.P.M. secured at all throttle positions. Evans Aircraft Fuel Pumps are endorsed by pilots and transportation companies everywhere. They are absolutely dependable.

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New York Office:
90 West Street
New York, N. Y.

253 Vinewood Ave.
Detroit, Mich.
Cable Address: EVCO—Detroit

West Coast Representatives:
Pacific Airmotive Corp., Ltd.
Union Air Term., Burbank, Cal.

Curtiss Rushes Work on Navy Planes

SEVEN HUNDRED additional men have been employed by the Curtiss Aeroplane and Motor Co. to help build 135 scout-observation planes for the United States Navy.

Rush orders for the construction of the new-type fighting planes, which will operate from the aircraft carriers of the fleet, were placed within five hours of the awarding of the contract which exceeds $2,000,000.

The new planes, which are the latest development in naval fighting equipment, will be long-range, combination scout and observation types, with the most modern armament equipment. They are a modernization of the Curtiss Hawks and are two-seater biplanes. The first completed plane is to be ready for delivery in July, with others to be completed at the rate of two a week until the last delivery is effected in August, 1936.

NACA Conference May 22

THE NACA will hold its Tenth Annual Aircraft Engineering Research Conference with executives and engineers of the aircraft industry at its research laboratories, Langley Field, Hampton, Virginia, May 22, beginning at 8:30 a.m., at the Langley Field theater.

The conference has been arranged to afford to the representatives of the industry an opportunity to receive first-hand reports of progress in aeronautical research at the Committee's laboratories and to witness demonstrations of the special facilities and methods used; and to enable the Committee to obtain the comments and suggestions of the industry as to the research problems which are felt to be of particular importance at present and which the Committee is especially equipped to study.

Underwriters Plan Lower Rates

THE ANNUAL meeting of Aero Insurance Underwriters, underwriters of aviation risks and successors to Barber & Baldwin, was held last month at their home office in New York.

Executives of the insurance companies who are members of the Underwriters discussed various problems confronting an insurance company underwriting this class of insurance and plans were considered whereby the cost of insurance to the flying public could be reduced. The work of the Engineering Department of Aero Insurance Underwriters has done much to help in the reduction of the cost of insurance.

Commercial Production Increases

TOTAL COMMERCIAL production in 1934 showed a 61.1 per cent increase over 1933, and a 325.9 per cent increase over 1932, according to reports issued by the Aeronautical Chamber of Commerce. Total military production however was lower.

The increase in value of aeronautical exports from $7,964,533 in 1932 to $9,155,182 in 1933 and to $17,548,181 i 1934, undoubtedly helped lessen the de cline in military production value, th Chamber reported, and to boost the commercial production value.

The average unit values of commercial airplanes increased from approximately $5000 between 1925 and 1932 to $10,323 in 1933, and $11,977 in 1934; military planes show a gradual increase from $11,575 to $20,333 between 1925 and 1934.

During 1934, according to the Aeronautical Chamber there were 772 commercial airplanes and 2048 engines produced. The combined value of these units was $20,228,102. For the same period, military production of aircraft reached 437 planes and 688 engines, with a valuation of $13,999,209, giving a total valuation of $34,227,311 for 1934.

Deliveries during the year kept pace with production. There were 775 commercial airplanes and 1939 engines delivered, and 434 airplanes and 687 engines for military purposes delivered during the period under consideration. Deliveries amounted to $32,981,358.

(Continued on following page)

Digest of Recent Events

England-Australia Solo Flight Record is Broken

H. L. BROOK landed at Lympne, England after a record-breaking seven day 19 hour 50 minute flight from Port Darwin, Australia. The previous unofficial record for a solo flight of this nature was held by C. J. Melrose who, in preparing for the MacRobertson Race last September, flew the distance in 8 days 9 hours. The official time for Jimmy Mollison, who set a record in 1931, was 8 days 22 hours. APRIL 1

Glider Record Almost Set By L. B. Barringer

FLYING THE Bowlus-duPont glider Albatros II in which Richard duPont established an American record of 158 miles, Lewin B. Barringer flew from Ellenville, N. Y., to a point ten miles north of Harrisburg, Pa., or 156.6 miles. Barringer was in the air almost seven hours. On a subsequent flight a few days later, Barringer's attempt to better his own mark was unsuccessful when he made a forced landing near Port Jervis. APRIL 3

Record-breaking Comet Continues Setting Marks

THE deHAVILLAND *Comet* used by Cathcart Jones and Kenneth Waller in their record round-trip flight between England and Australia, was flown by Captain Hugh Buckingham from Croydon to Paris, 220 miles, in 53 minutes, surpassing Frank Hawks' record by 14 minutes. The plane, one of two purchased by the French government, maintained an average speed of 240 miles an hour. APRIL 11

New York-Chicago Joined In 3 Hours 52 Minutes

PREVAILING EASTERLY tail winds helped a United Air Lines' Boeing transport to fly between Newark, N. J., and Chicago, Ill., in 3 hours 52 minutes to set a new commercial transport record. Pilot Paul Reeder flew eight passengers to Cleveland in 2 hours 19 minutes, and Frank Marton took the plane and seven passengers to Chicago in 1 hours 33 minutes. APRIL 7

Post Again Balked In Stratosphere Attempt

WILEY POST's third attempt to connect the two coasts by a record-breaking stratosphere flight ended because of supercharger difficulty on Purdue University's airport near Lafayette, Ind. Post left Burbank and came down 8 hours 12.5 minutes later, 1900 miles away in Lafayette with an average of 231.48 m.p.h. for his Winnie Mae. The second attempt took him to Cleveland at an average speed of 279.36 m.p.h. The average altitude on this flight was 33,000 feet. APRIL 14

Pan American Clipper Makes Round-Trip Pacific Flight

THE SIKORSKY S-42 Clipper Ship made a round-trip flight between Alameda and Honolulu to inaugurate experimental flights over what Pan American Airways hopes to make a commercial route between the United States and the Orient. Flying west in 17 hours 45 minutes to set a new speed record, the P. & W. powered flying boat landed at Honolulu where it remained a few days before the return trip. The eastbound trip consumed 2 hours 59 minutes for the 2400 mile flight. Capt. Edwin C Musick and a crew of five mad the trip. APRIL 17-24

AERONAUTICAL UNIVERSITY
APPROVED U.S. DEPT. of COMMERCE
1338 So. Michigan Ave. Chicago
Founded by Curtiss-Wright
BACHELOR OF AERONAUTICAL ENGINEERING DEGREE

Accredited Courses in
Aeronautical Engineering, Master Mechanics, Pilot's Ground Courses. Aviation Administration.
U. S. Government Approved Airplane and Engine Mechanic's School qualifies you for Government License in one year without serving an apprenticeship.
Reasonable Tuition
WRITE FOR FREE CATALOG A-D.

GLIDAIR FINISHES

FOR THE AIRPLANE INDUSTRY

FABRICOTE

RESTORES CHECKED AND CRACKED DOPE FINISHED AIRPLANE FABRICS

DOPES

CLEAR, PIGMENTED AND SEMI-PIGMENTED

ENAMELS RIPOLIN, SPEDENE AND FLEXIBLE LACQUER ENAMELS

PRIMERS SPEDENE AND OIL TYPES

VARNISHES SPAR-BAKELITE AND BRONZING

MAINTENANCE PAINTS FOR ALL PURPOSES

THE **GLIDDEN** COMPANY

NATIONAL HEADQUARTERS **AERO DEPT.**

CLEVELAND, OHIO

New Airplane Sensation!

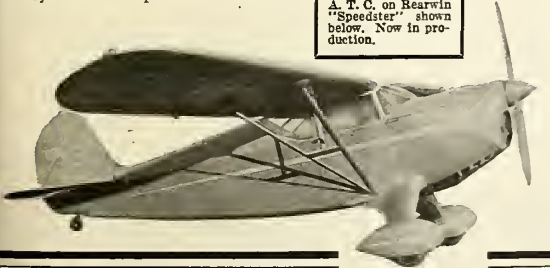
Rearwin-built! Priced Low!

THE New Rearwin Sportster is another Rearwin achievement—a slender, sleek, classy streamlined design. Truly the *most* airplane you could ever expect for the price. Easy to fly, easy to control, easy to land—lands so slowly and easily that amateurs learn to fly it in less than 3 hours.

Orders Booked Now!

Write or wire for full details and complete specifications. The graceful lines, beauty of workmanship and finish make the Rearwin Sportster the outstanding airplane. Tandem seats for two; comfort unsurpassed; perfect visibility; less than a cent a mile to fly; just the plane for student training. Powered with 5-cylinder 70 h.p. LeBlond motor.

U. S. Govt. has issued flight tests for A. T. C. on Rearwin "Speedster" shown below. Now in production.



REARWIN AIRPLANES, INC.

8th Year of Successful Manufacture

Fairfax Airport, Kansas City, Kansas, U. S. A.

The

STINSON RELIANT

is the

HIGHEST QUALITY

EASIEST TO FLY

LOWEST PRICED

(fully equipped 4-place cabin)

AIRPLANE

IN THE 225 H.P. CLASS

●

The

STINSON RELIANT

OUTSELLS

OUTPERFORMS

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ANY OTHER MAKE

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READ ALL ABOUT IT

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Stinson Aircraft Corporation,
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Send Stinson Plane News without cost to me.

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(Continued from preceding page)

Agencies Chosen in Texas

BRANIFF AIRWAYS has been appointed southern territory service representative for Pratt & Whitney engines and has equipped its Love Field, Dallas, shops with new machines, parts and tools to handle the work.

Dallas has also been chosen as an agency site by George L. Culver who will handle the Waco line. Four new models already have been delivered to Culver from Troy, Ohio.

Aircraft Sales

AIRCRAFT SALES at the Grand Central Air Terminal, Glendale, Calif., took a decided jump recently when six deals were consumated by Aircraft Industries, Inc., Stinson distributor. New 1935 Stinson Reliants were sold to the Union Oil Company of California, the Examiner Publishing Co. of San Francisco, Ruth Chatterton, the actress, and to R. C. Baker, president of Baker Oil Tools, Inc. In addition the following planes were disposed of: a Stinson SM7B, Wright-powered Stinson, Jr., and a Stearman Jr., Speedmail.

Bellanca Aircraft Corp., has sold and delivered a Cargo Aircruiser to Mackenzie Air Service, Ltd., of Edmonton, Alberta. The plane has a payload of 4021 lbs., and a radius of 550 miles at a cruising speed of 154 m.p.h.

Lockheed Electras are making more frequent appearances on airlines following delivery of seven to Northwest Airlines, and one to Braniff Airways where it is now being test flown over the Chicago-Brownsville division. Northwest has an additional order for five Electras now in production.

Interior of Mackenzie Bellanca Aircruiser

Actual delivery of the first production Ryan S-T was made when T. Claude Ryan, president of Ryan Aeronautical Co., flew a ship ordered by Leonard R. Peterson, Inc., from the factory in San Diego to Seattle, Peterson's base.

COMING EVENTS

The Intercollegiate Flying Club Air Meet will be held at the Municipal Airport, Northampton, Mass. May 4

•

Air Transport Day. Ceremonies and exhibits will be held at Newark Airport in which transport lines will coöperate. May 15

•

The Tenth Annual Aircraft Engineering Research Conference will be held at Langley Field, Hampton, Va. May 22

•

The Second Annual Good-Will Tour of the Wisconsin Veterans of Foreign Wars will visit 42 cities. June 16-22

•

National Intercollegiate Air Meet will be held at Purdue University Airport, Lafayette, Ind. June 22

•

The Sixth Annual National Soaring Contest will be held at Elmira, N. Y. June 29-July 14

•

Aviation Day, a feature of the Connecticut Tercentenary celebration, will be held at South Meriden, Conn., under the supervision of the local American Legion Post. July 5

•

A Class C Aircraft Show will be held at the Detroit City Airport, Detroit, Mich., under the direction of Ray Cooper. July 20-28

•

America's Schools of Aviation Day at the California Pacific International Exposition, San Diego, Calif., will feature a complete aviation program. August 25

February Exports Total $972,986

AERONAUTICAL EXPORTS for February, 1935, were somewhat lower than the preceding two months when the value of these products reached $972,986. Figures for December, 1934, and January, 1935, were $1,454,679, and $1,556,509 respectively. Twenty-one airplanes valued at $603,571 and twenty-two engines valued at $79,283 made up the bulk of the exported products, and $4,565 was realized from the sale of parachutes and $285,567 from aircraft parts and accessories.

China bought four airplanes valued at $78,620; three planes went to Brazil at $7,700 each, and three were delivered in Mexico at $5,399 for the lot. Japan purchased one plane, but its value of $140,368, made it the largest financial transaction in aircraft sales during the month. Two planes were exported to the United Kingdom, while one each went to Germany, Netherlands, Spain, Switzerland, Panama, Cuba, Argentina and Puerto Rico.

13,886 Pilots, 6,855 Aircraft Licensed

A SLIGHT increase in the number of licensed pilots and aircraft was noted by the Bureau of Air Commerce of the Department of Commerce in a report of the licenses issued to April 1, 1935. On that date there were 13,886 pilots and 6,855 aircraft licenses issued compared with 13,775 pilots and 6,600 aircraft on the same date a year previously.

The total number of aircraft, licensed and unlicensed, of which the Department had record on April 1, 1935 was 8,805 while this number of the corresponding day of last year was 8,917. Unlicensed aircraft (bearing identification numbers only) totaled 1,950 on the first of April 1, 1935.

Among the 13,886 persons holding pilots' licenses were 7,083 transport, 933 limited commercial, 5142 private, 720 amateur and 8 industrial. The licensed pilots included 359 women classified as follows: transport 67; limited commercial 31; private 219; and amateur, 42.

New York had more licensed aircraft than any other state with 860, but was one behind California in the number of licensed and unlicensed aircraft. California had 915 and New York had 914. California also had more pilots than any other state with 2522, while New York was second with 1396.

STANAVO
AVIATION GASOLINE
AVIATION ENGINE OIL
ROCKER ARM GREASE

• The TAYLOR "CUB" is SAFE • ECONOMICAL • STURDY • STABLE •

THE
TAYLOR "CUB"

AMERICA'S SAFE PLANE

Busy as bees at Andrew Airport, HONOLULU

Scene at Andrew Airport, Honolulu, showing CUBs and Instructors

"Easy and economical to maintain."

$895
Without Motor and Propeller

$1425
With Continental A40-2 Motor

$1495
With Aeromarine AR3-40 Motor

The growing preference for the Taylor CUB is well expressed by Olen V. Andrew, operating two CUBS among other larger planes at the Andrew Flying Service in Honolulu, Hawaii. He says: "The CUB is the nicest ship in its class I have ever flown. The general flying public so likes the CUBS they are busy when other ships are not. Students solo in 3 to 4 hours in CUBS. I particularly like the CUB because it's so easy and economical to maintain and operate."

By the way, have YOU ever tried a CUB?

NEW TIME PAYMENT PLAN More liberal terms. Makes the CUB easier to buy. Write for details.

TAYLOR AIRCRAFT CO.
BRADFORD - - - - PENNSYLVANIA

THE HIGHEST STANDARD OF VALUE

B★A★30
BALLOON AND AEROPLANE

A self-imposed weight maximum of 4 oz. to the square yard with a size
exceed 1 per cent. No starc
BA-30 you get *all* cotton.

Wellington Sears Company, 65 W
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Mix Sand and Spray wi

When you hear the chirp of the robin, t
spring holiday at these amiable beachfron
valuable credit-hours en route. While y
and our tempting Ocean Decks will cons
the briny, sun-drenched air. Cheerful l
entertainment will conspire to keep you i
Both . . . Moderate rates. American
Special weekly rates.

LEEDS AND LIPPINCOT
Chalfonte-Hadd
ATLANTIC C

A SCADTA liner over a palm-thatched village on the waterways. Caribbean and Pacific ports are joined in the seaplane network which operates throughout the Colombian Republic.

In 1920, SCADTA flew about 3000 miles, carried 12 passengers and one ton of freight. In 1934, SCADTA flew nearly a million miles, carried over 11 thousand passengers and over 1000 tons of freight. EDO-equipped Airliners, like this one shown in flight, meet the ever increasing opportunity for greater service.

Seaplanes for profit! Every plane in this picture of the SCADTA Airport, Barranquilla, Colombia, is float-equipped. The line makes connection with the Pan American Airways at this Base.

OLDEST AIR SERVICE IN THE AMERICAS EQUIPS WITH

EDO FLOATS

SCADTA, operating in the Republic of Colombia and oldest regular air service in the Western Hemisphere, chooses EDO All-metal Floats for the Ford transport recently added to its large fleet. Fifteen years of experience with water flying equip-

FOREIGN NEWS IN BRIEF

Canada

MONTREAL is to be the main eastern terminal of the airway, with lines from the eastern provinces, St. Lawrence River route and the United States converging. Westward from Montreal the airway goes via Ottawa following the northern transcontinental railway route through northern Ontario to Winnipeg. This northern route was picked because of the more advantageous weather conditions than are found the route along the Great Lakes, although the run is through isolated bush and lakeland. Here most of the emergency fields are at present being built.

From Winnipeg the route follows the southern section of the prairie provinces to Lethbridge, where the last part of the route starts through the Rocky Mountains, approximating the international boundary to Vancouver.

The entire airway will be lighted, equipped with teletype and telephone communication; almost 25 radio beacons will be located on the route. The same equipment will allow for two-way radio communication between plane and ground stations, as well as for weather broadcasting. Communication will be government-controlled, either through the proposed Department of Communications, or the present Department of National Defence.

The route of the airway will be entirely through Canada, except for one small section between New Brunswick and Quebec provinces, where the shortest way is across the State of Maine.

CANADIAN CIVIL aircraft in Canada flew 75,871 hours in 1934, an increase of more than 20,000 hours over 1933 and almost 19,000 hours over 1932. The planes flew 6,497,637 miles and carried 105,306 passengers, 14,441,179 pounds of express and 625,000 pounds of mail.

The increase in the number of passengers flown was approximately 31,000 compared with 1933; express flown was more than 10,000,000 pounds heavier than the previous year, and the mail increased about 86,000 pounds.

The number of aircraft operators increased from 90 in 1933 to 128 in 1934, while the number of licensed aircraft rose from 345 to 368.

THREE OF the Ontario government's fleet of forestry patrol planes will for the first time be equipped with two-way voice communication. The radio is being used to allow for faster communication in reporting fires and relaying instructions as to how to deal with them. Ground stations will be at Sault Ste. Marie, Algonquin Park and Sioux Lookout, in addition to those in remoter parts of northern Ontario.

CANADA'S GOVERNMENT-sponsored light airplane clubs showed an increase in membership during the past year, with 2,200 members enrolled in 22 clubs. They used 82 planes and flew 10,581 hours, marking increases over 1933. There were 535 members under instruction, with 133 achieving the private pilot grade and 21 the commercial pilot license.

AIR TRANSPORT activities of Canadian Airways, Ltd., in lower Canada are now conducted by Quebec Airways, Ltd., a new company which is directly affiliated with Canadian Airways. Desmond A. Clarke, president of the Clarke Steamship Company, is chairman.

Canadian Airways, which has operated the North Shore and Rimouski air mail service for several years, will confine its activities in the province of Quebec to aerial surveys.

Operations of the new company will be directed from the Desbarets Building, Montreal, with Romeo Vachon as superintendent of operations. He will be assisted by W. H. Coates and E. S. Neal. The fleet consists of three Fairchild 71's and one deHavilland Dragon.

THE DEPARTMENT of National Defense awarded the McKee aviation trophy for 1934 to Flight Lieutenant E. G. Fullerton, second in command of he Royal Canadian Air Force station at Rockcliffe, near Ottawa. This trophy, known officially as the Trans-Canadian trophy, was donated by the late J. Dalzell McKee to be awarded to the flier in Canada making the most meritorious contribution in the year to Canadian aviation.

Formerly chief flying instructor at Camp Borden, Ont., Flight Lieut. Fuller-on is credited with the introduction there of the latest methods of flying in-truction, instrument flying, air pilotage and altitude flying.

(*Continued on following page*)

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"THE THOROUGHBRED OF THE AIRWAYS"

(*Continued from preceding page*)

Czechoslovakia

A NEW transport plane has been placed on the market by Avia Airplane Co., a subsidiary of the Skoda Works. The plane is said to have a top speed of 205 miles per hour and a cruising speed of 174 miles. It is a low-wing, 12 passenger monoplane with three Hispano-Suiza engines of 575 h.p. each. The center engine is mounted in front of the fuselage and the outboard engines are streamlined into the wings.

Denmark

A BRITISH single-seat fighter built under license from the Hawker company at the Danish Naval Dockyard attained an altitude of more than 34,000 feet, a new record for Denmark. Power was supplied by a Rolls-Royce *Kestrel* supercharged, 12-cylinder, liquid-cooled engine. During the past few months the Dockyard has been constructing a batch of these planes for patrol, reconnaissance and defensive fighting over water. They carry a comprehensive military load, including two machine guns and more than 100 pounds of bombs.

Great Britain

WALLACE GENERAL Purpose planes now in course of construction for the Royal Air Force at Westland, are equipped with transparent hoods that completely enclose the two cockpits. The pilot is now protected by a sliding coupé hood with adjustable windows and quick-releasing hood. Over the gunner-observer's cockpit is a folding segemental hood that merges with the lines of the pilot's coupé in front and, when closed, meets the decking of the fuselage at the rear. By pushing the hinged segments forward and up, the gunner slides them into a space immediately behind the pilot's head, and is thus able to work his gun while being adequately protected from the slipstream.

THIS SUMMER D.H. 86 craft will be used to operate a new Imperial Airways service that will link London with Halle-Leipzig, Prague, Vienna, and Budapest, as an extension of the existing London-Cologne service.

JERSEY AIRWAYS, Ltd., has completed its first year of operation. The

service between Heston and Jersey, started with one Dragon twin-engined transport, is now being operated by a fleet of eight. During the year 20,000 passengers were carried, and 1,500 crossings of the Channel made. This year the fleet will be increased by six Diana-class four-engined airliners.

GATWICK AERODROME in Surrey is to become one of the principal civil airports serving the Greater London area, and a terminus for a number of inland and Continental air services. It will be known as "London South," and development plans include the building of a railway station adjoining it, and the provision of fast train connections with the center of London.

INCOMPLETE RETURNS from 26 of the 30 subsidized clubs shows an aggregate membership (as of December 31, 1934) of 7,116 against 4,800 the year before. Active flying members totaled 4,016; hours flown were 33,968 and the number of flights made was 75,000.

THE SOCIETY of British Aircraft Constructors will hold its fourth annual Flying Display and Exhibition at Hendon on July 1. As before, the event will take the form of a demonstration in private, before guests of the Society, of the qualities of the later types of British civil and military aircraft. Last year eighteen hundred guests, including representatives of civil and military aviation from forty countries, watched the flying, and inspected the planes and the exhibition of engines, parts, materials and accessory equipment housed for the day in a shed beside the field.

DETAIL CHANGES in design have improved the performance and comfort of the three-place low-wing cabin Percival *Gull*, the latest model of which was demonstrated last month at Gravesend by E. W. Percival, its designer. Frontal area has been reduced by adopting an improved form of fixed streamlined cantilever landing gear. Long-chord split trailing edge flaps were installed reducing the landing speed to 43 m.p.h., and slightly larger doors were fitted to the cabin. The *Gull* is available either with a 130 h.p. deHavilland Gipsy *Major* or with a 200 h.p. Gipsy *Six*. Performances for the more powerful model are: maximum speed, 172 m.p.h.; cruising speed, 152 m.p.h.; and range, 600 miles.

TWO SQUADRONS of the Royal Air Force are being re-equipped with the new Boulton-Paul *Overstrand*, the twin-engined bomber which has a mechanically-operated rotatable gun-turret in the nose of the fuselage. This turret eliminates difficulties of gun operation at high speeds and renders marksmanship from a plane moving at more than 200 miles an hour accurate and untiring.

A NEW airport for Manchester has been approved by the city council and the Air Ministry. It will be built at Ringway, Cheshire, to replace the present airport at Barton which recently was condemned. Work will be begun shortly in order that the airport may be in use by the summer of 1936. There are 660 acres of level grassland available just within the boundary of the County of Cheshire and 9 miles from the center of Manchester. The estimated cost of the undertaking is approximately $874,-

(*Continued on following page*)

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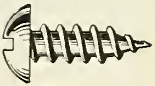

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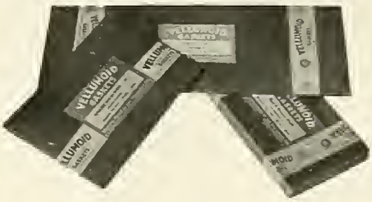

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(*Continued from preceding page*)
800; the completed airport will be one of the largest in the United Kingdom, and will not only be a regional but also a municipal link with Europe.

TWO EXPERIMENTAL planes, one of which will attempt an altitude record in the stratosphere, and the other a distance record, are now being constructed in Great Britain by authority of the Air Ministry. It is hoped that the stratosphere plane will be capable of climbing to more than 50,000 feet. The distance plane is being built with a view of determining the absolute range of the modern plane, and it is hoped that it will reveal that a military plane can be constructed with sufficient range to reach any part of the Empire without landing on foreign soil.

ENGLISH FLYING clubs increased their activity in 1934 by about 40 per cent and thirty clubs, of which two are in the process of formation, received assistance from the government. Complete returns have been supplied by 26 clubs showing their aggregate membership to be 7,116 as against 4,800 in 1933. Active flying members numbered 4,016, compared with 2,565 on December 31, 1933. The recorded flying time was 33,968 hours in 1934 contrasted with 26,695 in 1933.

THE SIXTEENTH R.A.F. display will take place on June 29 at Hendon and immediately after, almost all of the units participating will go to Mildenhall, Suffolk, which is the selected assembly base and flying headquarters of the Jubilee Review by the King on July 6.

A SUBSTANTIAL order for the Dagger 24-cylinder H-shaped engine has been received by D. Napier & Son, Ltd., from the Air Ministry for the Royal Air Force. These engines, which will be installed in Hawker Hart day bombers, are capable of delivering 665-690 h.p. at 3500 r.p.m. at 10,000 feet. Their maximum output is 730-760 h.p. at 4000 r.p.m. at 12,250 feet. The cylinders in the engine are arranged in four banks of six, two upright and two inverted. The frontal area consists almost entirely in the projected area of four cylinders. Another advantage in the design is that rotational speeds higher than usually demanded of engines are made possible. In addition to this order, the Air Ministry also placed orders for a number of Napier Culverin Diesel engines of 720 h.p.

Italy

SUBSIDIES FOR purchasers of private sport planes in Italy were provided for in an official decree recently issued. The purchaser must be a citizen holding a pilot's license, and the amount of the allowance is to be decided by the Air Ministry, but it may not exceed 50 per cent of the value of the plane. The grant will only be made if the plane is of new construction and purchased directly from the manufacturer; if the engine is of Italian manufacture; and if the plane is not used for profit. The amount of subsidy, in each case, will be calculated on the airplane, including essential instruments, but foreign instruments and accessories will not be included in the valuation.

ROME-FIUME service is to be inaugurated this summer on a daily schedule by Ala Littoria. The flights will be made in 2½ hours by 10-passenger planes. A stop will be made at Falconaro to pick up passengers to and from Zara, and the schedule will be timed to coincide with that of the international services. It is hoped that this service will be of benefit to the fishing industry and enable fish to be on sale in Rome a few hours after leaving Fiume.

During the summer it is planned to increase the seating capacity of planes now flying between Fiume and Venice to 10, and also to speed up the transportation of fish for the Milan market.

Mexico

APPLICATION FOR a permit to operate a passenger, mail and express service between Acapulco, Guerrero and Oaxaca City, with stops at Ometepec, Guerrero, and Pinotepa Nacional, Tututepec and Pochutla, Oaxaca, has been filed with the Ministry of Communications and Public Works by Compania de Transportes Aereos del Pacifico, S. A.

DAILY ROUND-TRIP passenger, mail and express service between Mexico City and Acapulco, a west coast resort, has been established by Aeronaves de Mexico, S. A. The round-trip fare for the 650-mile trip is about $16.

THE POST Office Department is considering petitions asking that proceeds of a special of air mail stamp issue, published to provide an endowment fund for the National University of Mexico, be used to subsidize commercial aviation that will serve remote regions of the country.

Portugal

PORTUGAL HAS ordered six Blackburn Shark seaplanes which will be added to its Naval Air Service for reconnaissance work. Additional fuel tanks will be installed for long-range work. Powered by the Siddeley Tiger LIV, a 14 cylinder engine, the Shark, as a seaplane, attains a maximum speed of about 150 m.p.h., and with the additional fuel tanks, has a range of almost 1000 miles. The Tiger engine is one of the new developments in the Siddeley line. It is a radial air-cooled unit rated 700 h.p. at 2150 r.p.m. at 5000 ft., and 744 h.p. at 2450 r.p.m. at 6000 ft. Complete with accessories, the engine weighs 1191 pounds. Its displacement is 1996 cu. in., and its compression ratio 5.35:1.

LIEUT. COSTA Macedo and C. E. Bleck, flew non-stop from Hatfield near London to Lisbon, Portugal in 6 hours 5 minutes, averaging about 200 miles an hour for the flight. Their plane was the Comet in which James and Amy Mollison set new records during the MacRobertson races. The plane has been purchased by the Portuguese government for experimental purposes, and will make a flight across the South Atlantic from Lisbon to Rio de Janeiro as one of a series of experimental ocean flights.

Poland

INCREASED APPROPRIATIONS for the development of civil aviation in Poland are contained in the preliminary budget for 1935 in which an expenditure of $3,408,160 is requested. This compares with $2,589,440 received last year. The leading items included in the budget are for airlines, scientific organizations, aviation associations, and training of personnel.

Russia

NEW AND more highly developed planes will enter the Soviet civil aviation service this year, according to A. K. Dawson, Director of the Russian Division of the American Express Company.

Tests of the KHAI-1, a mail and passenger plane were completed recently by the Airplane Institute of the Civil Air Fleet, following completion of the design by the Kharkov Aviation Institute under the direction of Engineer Neman. It will have a speed of about 202 m.p.h., enabling it to fly from Moscow to Tiflis in almost half the time now scheduled. The KHAI will carry six persons; it is constructed entirely of wood, is powered by a Soviet engine and features a retractable landing gear.

Tests have also been completed on the new STAL-3, an all-metal plane, with accomodations for six passengers and a crew of two. It has a top speed of 143 m.p.h., and a cruising speed of 118 m.p.h. After its tests, the STAL-3 plane was put into production, and in the near future the first of these will be delivered to the Civil Air Fleet.

The MP-1, successfully tested recently by the Airplane Institute, is a single-engined flying boat with accomodations for six persons in addition to the crew. It has a cruising speed of about 125 m.p.h., and will go into regular service on the Black Sea coast, between Odessa, Novorossisk, Sevastopol, Sochi and Batum, as well as in the North.

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PERSONAIRLITIES

(*Continued from page* 20)

in the great battle of commercial aviation. He was appointed a Lieut. in the Army Air Corps Feb. 14, 1924, and assigned to the 95th Pursuit Squadron, First Pursuit Group, Selfridge Field, Mich. At that time Jim Farley was not even a ward-healer, so the Army didn't have to try its hand at flying Air Mail in Thomas-Morse scouts. Old man Coolidge was on the throne and partial sanity still reigned in Washington, Mrs. Coolidge wasn't doing radio sales talks for the Simmons Beauty Rest Mattress, either. In those days the First Lady of the land merited the title.

Virgil Simmons (no relation to the Simmons Mattress Co.)—had extensive experience in night flying before and after the establishment of lighted airways and lighted airports. He was considered a bit of an owl in those days, and instructed in night flying, teaching students how to make their eyes bug out so they'd see further at night by distending the pupils, as cats and owls do, for owls used to do night flying long before the Department of Commerce lit things up for them. He spent two years with the U. S. Forest Service as Chief Federal Patrol pilot, Field Unit, 6th National District, which included Washington, Oregon, and Western Idaho.

After that he went with Boeing for three years, during which he instructed and flew mail on the Oakland-Salt Lake Division. Then he was pilot instructor for the President of the Fawn of San Francisco Ltd. and acted as an executive in the Production Dept. of that company. His flying experience has covered 16 years of continuous service on many types of military and commercial airplanes. He has carried over 20,000 passengers without injury to any and up to March 11, when I last heard from him, had flown 4,568 hours, or nearly as much as a young private pilot I was talking to the other day, who told me that he had his license a year now and had flown 5,000 hours, which I thought very enterprising of him, indeed.

ANTARCTIC AIRCRAFT

(*Continued from page* 15)

had been photographed on the previous expedition for the first time, but only from one angle, were rechecked and photographed again from many angles. The photography of these and other mountain ranges was carried to the limit of the planes' endurance in securing views of hitherto unknown areas.

A casual check of these flights before breaking camp for the return to civilization, indicated that no land existed north of Marie Byrd Land. In addition, the coast line was traced and outlined for almost 300 miles to the east of the Edsel Ford Range and the Queen Maud Mountains were extended to the east until they merged into a plateau. This plateau was traced by Harold June, chief pilot of the expedition, at an altitude of 4000 feet from the coast to the Queen Maud Range, indicating that no channel exists between the Weddell Sea and Ross Sea and that the Antarctic continent is solid land.

The planes were not only used more extensively than before, but June made a number of flights in inclement weather in which he demonstrated that instrument flying was possible even at the bottom of the world. One of his most interesting undertakings was to aid in making seismic observations. In this effort about 14 or 15 landings were made away from the established base. Another interesting use to which the planes were put was in measuring surface altitudes while determining the geographical outlines of the country. June obtained contour lines showing the gradual rise of the plateau to the east between the coast and Queen Maud Mountains by touching the skis of his plane to the ground every 20 miles, noting his altimeter and recording the surface height.

Added to the difficulties in aircraft operation were such problems as preheating engines and oil at low temperatures, continuous digging out of planes after a storm when they often became almost wholly drifted in, and the erratic and rapid change in weather which made long-distance flying hazardous.

Despite the difficulties encountered much more is expected from the work of this expedition than from that of the former trip. As a result of the increased flying activity which led to numerous discoveries from the air, fewer "unknown" areas will appear when the Antarctic region is remapped.

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• HYDROGRAPHIC OFFICE Publication No. 188 *Naval Air Pilot of the Alaska Peninsula, Southern and Southeastern Alaska,* is designed to furnish information of assistance in the navigation of aircraft in the aforementioned areas. Divided into three parts, the publication contains: (1) general information concerning topographic features, operating facilities, meteorological conditions, air routes and distances; (2) detailed information and sketches of seaplane anchorages, and landing fields; (3) photographs of seaplane anchorages, landing fields and other aids to navigation in the air.

The detailed information of landing fields is similar to the information issued by the Hydrographic Office on airports and landing facilities in this country and contains a description of the field, its location, landing and take off area, facilities and general information. The maps are done in two colors.

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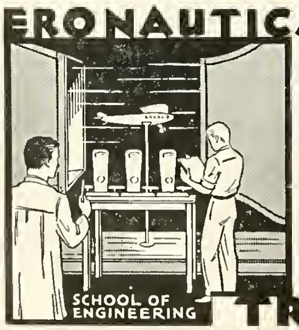

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FOR SALE: 1934 Continental Cabin Waco. Excellent condition. Finish like new. Electric starter, generator, battery, landing lights, bank and turn, rate of climb, Lear radio, air brakes, and 70 gallon tanks. Airplane bonded for radio transmitter. Engine modernized, with salt-cooled valves and new type master rod bearing. $4,500 at duPont Airport, Wilmington, Delaware.

FOR SALE: Fairchild 42 Agricultural Crop Duster. 300 Wright. Bank turn, rate climb, electric starter, generator with voltage regulation, electric driven remote control hopper. Hopper carries 1.000 lb. of dust. This is an opportunity for a good flier to make some real money. Also will sell Wright Gipsy parts, cylinders, valves, direct Eclipse starter, crankshaft, camshaft, etc. Parts equal to new. Also J6-9 cylinders. Two Gipsy Wright propellers. Fraser, 2056 Ryder Street, Brooklyn, New York.

J6-5 STRAIGHTWING WACO: Fuselage recovered, high lustre finish; engine majored and modernized; electric starter, $1,375. Waco '32 cabin, 210 Continental, factory major, $2,250. Driggs Skylark, inverted 75 h.p. Rover, excellent condition, ideal trainer, $850. Warner Stinson, total time 420:20, equipped with side by side duals, price $850. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

J6-7 STEARMAN: Motor just overhauled at cost of $600, ship in excellent condition and has many extras, including flare, rate of climb and bank and turn, $1,900. 2 J6-5 motors, completely overhauled and modernized, including clutches, new style pistons and Timken bearings in rocker arms, $500 each. Many other reconditioned parts at considerable saving. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

11 AIRPLANES FOR SALE OR TRADE: Stinson Sr., six-place, J6-9. Driggs Skylark, Rover powered. 2 J6-5 Travel Airs; 2 J-5 Straightwing Wacos. Kinner B-5 Waco F. Lambert Cavalier Coupe. OX Travel Air. OX Waco 10. Heath Parasol, powered with Wright Morehouse. Trade in your ship or will accept cars of late model. Terms if desirable. Two almost new white silk Irvin seat parachutes. Steel propellers for J-6 and J-5. Few brand new Hamilton wood props at $15. Flottorp, Marshall and Bennett propellers carried in stock for all motors. Write for details. Central Air Service, Grand Rapids, Michigan.

KINNER SPORTSTER: Two-place, side by side, low wing monoplane, powered with 100 Kinner engine just top overhauled. Total ship and engine time 275 hours. $1,700. Wings Corporation of Philadelphia, Ambler, Pennsylvania.

WARNER FLEET: 150 hours since major. Special rocker box assembly. Dope and fabric perfect. Licensed till next March. Make offer. Want Stinson. Goodwill Air Service, Bernhart's Postoffice, Pennsylvania.

SKYLARK OWNERS: Driggs Skylark, deluxe model, now ready; DH Gipsy powered. Will finish to customer's colors. Trade in your Rover Skylark, others considered. The price will be a pleasant surprise. Skylark Aircraft Corp., Muskegon Heights, Michigan.

TAYLOR CUBS: Trade in your plane or car on a new Cub; 12 months to pay. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Penna.

DRIGGS SKYLARK: 600 hours, excellent fabric, Rover engine recently majored; licensed May 1936. Also Hisso Eaglerock, Aeronca C-3, Cessna, J-5 Fairchild. Air Activities Airport, West Chicago, Illinois.

LAMBERT DE LUXE MONOCOUPE: 95 hours, seven months old; has turn and bank, starter, battery, red leather upholstery, wheel pants; gray trimmed in red. Never damaged, always privately owned. Will accept trade. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Ind.

AMERICAN EAGLE: 3-place, Kinner K-5; J-5 Waco Straightwing; Bull Pup; J-6 240 Travel Air, 4-place. Others. Chuck O'Connor, Barnes Airport, Westfield, Massachusetts.

AEROMARINE KLEMM: Overhauled LeBlond 65. Excellent condition, licensed. Cash price. $550 our field. Immediate delivery. York Flying Service, Inc., York Airport, York, Penna.

KINNER 100 H.P. ENGINE: Late type, complete with front exhaust heads and collector ring. 225 hours, 20 since overhaul. Perfect condition. $300. John D. Jacob, Malvern, Pennsylvania.

LATEST DE LUXE MODEL Great Lakes: Airwheels, brakes, steel propeller and high polish finish. Aeronca Scout with landing gear and floats. Licensed. J. Tyler Thomas, 1568 Cherokee Road, Louisville, Kentucky.

FOR TRADE: Licensed Fairchild KR-34. Modernized Wright J6-5 175 h.p. motor, 300 hours total time. Just recovered, special paint job, special landing gear, full airwheels, brakes in front and rear cockpit, tail wheel, starter, dual controls. Want a Stinson or Waco cabin. Buddie Childress, 2414 Orange Ave., N. W., Roanoke, Virginia.

VELIE MONOPREP: Recovered last spring. Excellent condition. Identified. Sell for $300 cash or might consider car worth $125 as part payment. Arnold Sieloff, Alden, Iowa.

CRACKED HISSO E WACO: Wings, prop, fin, rudder damaged. $300 will relicense. Sacrifice for best cash offer. Details on request. I. L. Kimsey, Taos, New Mexico.

FAIRCHILD 21: One of last of this type manufactured; Kinner 100 h.p., reinforced heads; fabric perfect condition; always privately owned, hangared; never cracked; 40 hours since major overhaul; thermopete, Hartzell propeller; new type roller bearing hubs with brakes and airwheels. AERO DIGEST, Box 2063.

LICENSED OX ROBIN: 165 hours total. Like new. Price $475. Fledgling with Challenger, $850. Stinson SM8A Lycoming, $1,450. Meinke-Eldred Flying Service, Willoughby, Ohio.

TRAVEL AIR 4000B: J6-7. New recovered. Beautiful red and black hand rubbed finish. Motor completely overhauled and modernized, cowling painted. New windshields. Speed ring. Total time 320 hours. A real bargain. $1,500. Kindred Flying Service, Enid, Oklahoma.

KINNER BIRD: Air wheels, brakes, perfect condition, $1,050. Waco F: Ship majored, recovered, very flashy job. $1,650. Cracked Eaglerock, $100. Kinner, J-5, Heywood, many other parts. Want airplanes—Kinners, J-5, any parts. Crane Garage, Toledo, Ohio.

OX-5'S: WACO 10 just relicensed, oleos, compass, many improvements, $450. American Eagle, like new, $375. Take car. H. Feilhach, 5378 N. 36th St., Milwaukee, Wisconsin.

FAIRCHILD KR-34: 3-place open, Wright J6-5, modernized. Ship and motor 240 hours. Need cash, will sacrifice. Licensed August 1935. Always privately owned. Descomh, 100 Church St., Weathersfield, Connecticut.

SAVOIA: 3-place amphibion, in perfect condition. New type 100 h.p. Kinner. Just top overhauled. many extras. Must sacrifice. Paul Lonquich, 12 Highland Avenue, Yonkers, New York.

FAIRCHILD 22: In excellent condition. Cirrus motor completely rebuilt. $1,350. Wings Corporation of Philadelphia, Ambler, Pennsylvania.

PITCAIRN J-5: Less than 50 hours since complete recover and overhaul by Curtiss-Wright. Curtiss Reed metal prop and airwheels. $1,500. G. M. Downs, Municipal Airport, Ann Arbor, Michigan.

BELLANCA SKYROCKET: Ideal ship for sportsman, executive, photography, etc., just relicensed. Keystone Commuter, just majored and in perfect condition. Sikorsky S-39 with Sperry horizon and many extras. Challenger Eaglerock and many others. All ships with minimum hours, licensed and attractively priced for quick sale. Phone Independence 3-4843. Jaros, 48-03 Ditmars Blvd., Astoria, L. I., New York.

LOENING AMPHIBION Air Yacht: Eight-place, with spare Cyclone motor. 25 hours since major. just relicensed, price reasonable. Consider good flying proposition. Spencer Laboratories, Akron, Ohio.

FAIRCHILD 22: Inverted Cirrus, 90 hours since complete factory major. Extra instruments, brakes. Color green and cream. Ship cannot be told from new. $1,695. Richard Poor, Congressional Airport, Rockville, Maryland.

NEW LAMBERT CAVALIERS: With NC license; for sale, less engine and propeller, $500 each. New Cavalier with factory rebuilt Lambert, licensed and ready to fly, $1,200. Star Aircraft Company, Bartlesville, Oklahoma.

$295 BUYS OX-5 Millerized Eaglerock plane. Plane and motor in perfect condition, licensed. Will accept car as part payment. Terms can be arranged. Pioneer Aviation Co., Airport, Syracuse, New York.

J6-5 PARKS: Just rebuilt and recovered; licensed February 1936. Engine 130 hours. Consider Standard or Bird trade. Extra J6-5; inertia starter; Pyle landing lights; Hamilton hub; everything priced right. Edward Taafe, Winter Haven, Florida.

AERONCA ALMOST NEW: 65 hours, special paint, heater, navigation lights, compass, air speed, thermocouple, brakes, streamline, tires. $1,750, cash. J. C. Rolfe, 40 Jersey Avenue, New Brunswick, New Jersey.

GOING ABROAD: Arrow Sport, LeBlond 65, turns 1950 on ground; perfect condition. 4 to 5 gal. per hour. Attractive colors. Always hangared. Very reasonable. Jacob Fischer, 5214 Brookville Road, Indianapolis, Indiana.

WARNER ARISTOCRAT: Three-place, $1,100 or trade for Warner Monocoupe. H. K. Canfield, 315 Main Street, Stroudsburg, Pennsylvania.

FLEET: Kinner-powered, $1,150. J-5 Travel Air, $1,185. J-5 Eaglerock, $1,175. All ships newly recovered and refinished. Will relicense for purchaser. Terms arranged. Wire for preference. Pioneer Aviation Co., Airport, Syracuse, N. Y.

TRIMOTOR STINSON: First class condition, 20 hours since major overhaul, controls, fabric A-1; late type instruments, flares; licensed to October. K-5 Kinner Fleet: Only testhopped since major overhaul and complete recovery; complete instruments, navigation lights, full balloons. Write best offers Associated Aviation Corporation, Milwaukee, Wisconsin.

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10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

● PLANES & ENGINES FOR SALE

DE LUXE 330 WASP JR. 4-passenger Stinson: Blind flying equipment; cruises 125 m.p.h. Few hours, perfect condition. Asking $2,750. Will trade. Write your offer to AERO DIGEST, Box 2066.

1934 STINSON RELIANT: 325 hours, $3,750. Neil R. McCray, Fairview, Pennsylvania.

CHALLENGER FLEDGLING: 185 h.p.; licensed to May 1, 1936. Perfect condition. Airflights, Inc., Hangar 32, Roosevelt Field, Garden City, New York.

COMPLETELY REBUILT J-5 engine, with Hamilton metal propeller. Very reasonable. J. R. Harrington, 375 Lexington Avenue, Mansfield, Ohio.

TAYLOR CUB, $750. Kinner Eaglerock, $775. American Eaglet, $565. OXX-6 Waco 10, $485. OX-5 Travel Air, $395. Robin, $400. Terms to responsible parties. Wire for preference. Pioneer Aviation Co., Airport, Syracuse, New York.

● WANTED TO BUY OR TRADE

WANTED AT ONCE for cash: Seven late type Wright Whirlwind cylinders with side exhaust. Also good J-5 and Lycoming motors, with propellers and starters. Give full description, hours and best price, first letter. Michigan Aero Motors, Jackson, Michigan.

WILL EXCHANGE for a popular make of airplane: Seven room frame house in Long Island, with garage, on lot 26x100. House cost $10,600. Present mortgage, $4,200. Amortizing mortgage $45 per month. Write to Wm. J. Overton, 3411 Steuben Avenue, Bronx, New York.

WANTED: Licensed four-place cabin ship, about 200 h.p. Brakes, starter, duals (2 wheels) essential. Prepared pay maximum, $2,000, f.o.b. New York City. Send fullest particulars dimensions, performance (including take-off and land), consumption, hours, history and photos. Describe additional equipment, if any: e.g., blind flying instruments, drift sight, radio, silencer, slots or flaps. AERO DIGEST, Box 2051.

WILL TRADE AUTOMOBILES for a light airplane. Ship must be late model, in good condition. Located in middle western state. AERO DIGEST, Box 2047.

WANTED: Used Cessna J6-7. State full details first letter. AERO DIGEST, Box 2048.

WILL PAY CASH for airplanes, engines, or parts in any condition. Write complete details, prices, etc., in first letter. J. E. Poission, 1219 Penn Ave., Grand Rapids, Mich.

WANTED: Aeronca, Taylor Cub or other light plane, needing recovering or repair; must be cheap for cash. Box 263, Bridgeville, Pennsylvania.

CASH WAITING for used airplanes, engines and parts thereof, in any condition. Write complete details, prices, etc., in first letter. Munch & Romeo, Hangar 32, Roosevelt Field, Mineola, N. Y.

WANTED AT ONCE for cash: J-5 Travel Air, Waco or similar ship. Give full description, best price, first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

HAVE BEAUTIFUL 3¼ carat diamond ring, value $1,200, and some cash for good licensed air-cooled ship. What have you? AERO DIGEST, Box 2056.

WILL TRADE 1930 26-foot mahogany Chris-Craft speed boat, 125 h.p. Chrysler marine motor, for any good licensed plane, preferably seaplane. Address R. M. Clifton, Room 712A, 545 Fifth Avenue, New York, N. Y.

WANTED: Crankshaft for LeBlond 60. Willis Hammonds, Omaha, Arkansas.

WANTED: 2- or 3-place light open plane. Licensed, air-cooled, duals, brakes. Prefer biplane. Cash. Give details. No crack-ups. Robert Diehl, Manheim, Pennsylvania.

WANTED: Will pay cash for two-place airplane; prefer Davis or Great Lakes. Full description first letter. Henry Douglas, 936 Madison St., Oak Park, Illinois.

WANTED FOR J-4B: One cam ring and gear complete; one timing drive gear; complete accessory gear assembly; one thrust bearing; one set magneto drive gears and bearings. For sale or trade: Quite a few J-4 and Cirrus parts. Southwest Aviation & Service Corp., Box 53, Oklahoma City, Oklahoma.

WANTED: Lower wings with fittings for Travel Air 2000, also wing struts and OX-5 propeller with spinner. Forest Reed, Eagle, Wisconsin.

WANT SMALL AMPHIBION: Pay cash or trade Cirrus two-place cabin or Chrysler Imperial Sedan. G. Landis, 926 North Jefferson Street, Milwaukee, Wisconsin.

WANTED: One seaplane. Will pay up to $1,500 cash. Must be small and economical. State best price and full particulars. Fred C. Williamson, Cockeysville, Maryland.

WANTED: Best two- or three-place airplane $400 will buy. Must be licensed, A-1 condition, never cracked. Give complete details. Box 182, Nashville, Tennessee.

WANTED: Sikorsky S-38. State condition and history in first letter. Also what equipment extra and lowest cash price. AERO DIGEST, Box 2061.

WANTED: Waco F, Fleet or similar ship. Must be licensed, priced under $1,000. Cash proposition. Describe fully first letter. Bert Iten, Fort Ripley, Minnesota.

WANTED: OX Eaglerock, Travel Air, Robin, Bird or similar plane. Consider two- or three-place radial job needing slight repairs or covering. Give particulars in first letter. For sale: Eaglerock parts. Challenger Robin wing struts and tail surfaces. Peter Bryn, Hannaford, North Dakota.

$400 CASH for light plane. Prefer Aeronca or Eaglet. No OX jobs. State all first letter. E. X. Miller, 459 Massachusetts Ave., N. W., Washington, D. C.

WANTED: Kinner Bird parts, all kinds, any condition; full details and prices first letter. Need complete OXX-6 motor. Vanair Transport, Inc., 2033 Fernwood Ave., Toledo, Ohio.

WILL TRADE: Chrysler 70, equipped gas engine, generator, amplifier, turntable, microphone, radio and three trumpets on top, new paint, sounds good; for air-cooled two- or three-place licensed cabin or open job. I. U. Patterson, Ritz Theatre, Tulsa, Oklahoma.

WANTED: Three- or four-place open or cabin ship, powered with J6-7 but minus engine. Give complete details. J. R. Harrington, 375 Lexington Avenue, Mansfield, Ohio.

WANTED: One all steel hangar, at least 40′ x 50′. One all steel single plane hangar. State final price. R. Young, Box 102, Dover, New Jersey.

WILL PAY CASH for your airplane or equipment. Will also sell your airplane on consignment at no cost to you, results guaranteed, quick action, reliable. Write Pioneer, Airport, Syracuse, New York.

● POSITIONS WANTED

ENGINEER: 10 years' experience design, construction flying boats and landplanes, expert stress analyst, seeks responsible position offering future opportunities. AERO DIGEST, Box 2018.

TRANSPORT PILOT: 5 years' experience instructing and cross country work. Own 5-place licensed ship. Will go anywhere. Reference on request. AERO DIGEST, Box 2059.

YOUNG MAN: 22, single, desires position with individual or firm. Graduate Marshall Flying School, Marshall, Missouri. Mechanical course and 50 hours solo. Can go anywhere. Minimum salary. References. Ambitious. Employed now. Gerald R. Blank, 241 N. Ninth St., Allentown, Penna.

● MISCELLANEOUS PRODUCTS AND EQUIPMENT

WAR RELICS for clubhouse or den. Vickers aircraft machine guns; cost government $700; rendered unserviceable without marring. Only $7.75 each, f.o.b. New York. Sent C.O.D. on payment of $1. Weight 33 pounds. Fiala Outfits, 47 Warren Street, New York, N. Y.

SIKORSKY S-39 HULL, wings, center section, tail group, undercarriage, pontoons and various other parts; never used and in fine condition; to be sold at approximately half of cost price. AERO DIGEST, Box 2044.

FOR SALE: Fleet parts. Everything including lower wing assemblies, complete. 60% off factory list prices. Write Wm. Henry Weeks, Municipal Airport, Kansas City, Missouri.

DON'T BUY ANYTHING until you get Ort's 1935 Aviation Material Catalog. Prices are lower. Send thin dime today. Karl Ort, 621 W. Poplar St., York, Pennsylvania.

FOR SALE: One Eastman K-1 mapping camera, size 8 x 10, 100 exposures; one Elwood 8 x 10 rectifying, mapping and enlarging camera, brand new; one 8 x 10 contact printer, also complete stock of supplies and paper; just completed contract. Will sell cameras, printer and supplies, $650. Can supply samples of work and give operating instructions to purchaser. One Standard steel prop for Kinner K-5, $55; one Standard steel prop for OX-5, $35. 2 Robert Bosch magnetos for Kinner K-5, $20 each. Finklea Brothers, Leland, Mississippi.

FOR SALE: Set Edo floats, Model 3300. Complete with all struts, fittings, fins and water rudders for Waco cabin ship. Floats used but few hours. Excellent condition. Never used in salt water. Also licenseable on Stinsons. AERO DIGEST, Box 2057.

J6-5 ENGINE: Completely overhauled and modernized with clutch, new type pistons and Timken bearings in rocker arms, $500; J-6 cylinders, reconditioned, $25 each; J-6 overhauled magnetos, $25 each; J-5 engine, good condition, $350. Kinner K-5 main case, good condition, $40; many other reconditioned engine parts offered at substantial saving. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

KINNER B-5: 125 h.p. motor, with Heywood starter. Serial 201. Total time, 291 hours. No time since top overhaul. $350 cash. Several Savoia parts. Trade all or part for OX-5 job. Also have parts for Monocoupe and Velie M-5 motor. Dick Life, 2504 Murdock Ave., Parkersburg, W. Va.

FOR SALE: Good Warner motor; right top wing; flying wires; axles, wheels, tires, brakes, pedals, instruments for Travel Air biplane. Cheap. Earl Sark, Bowling Green, Kentucky.

ENGINE PARTS: J-5 main cases, crankshaft, cylinders, rocker boxes, hub for steel propeller. Velie M-5 cylinders, magnetos, carburetors, front and rear cases, all gears and valve actions. Set Lambert 90 cylinders, pistons, complete steel propeller. Curtiss Challenger main case, master rods, cylinders, oil sump assembly, Scintilla magnetos, steel propeller hub. Warner late series master rod, pistons and pins, rear case, push rods, gears, magnetos. Cirrus American and English heads, cylinders, crankshaft, Scintilla magnetos, lower and upper crankcase. Great Lakes 2T-1A wing struts, landing gear, all wing fittings and wires. Travel Air 2000 and 4000 models center sections, speedwing, some with tanks, two wing panels. Szekely wood propeller. Many other reconditioned parts, reasonable prices. Dunaway Garage, 2201 Indiana Ave., Kansas City, Missouri.

TIRES: 650 x 10 wheels, brakes; 950 x 12; 1100 x 12; in original wrappers, at big discounts.. We have bought most of the Buhl Aircraft factory and still have a big slew of various materials, parts, instruments, spruce, Szekely parts and what not. Send in your inquiries for prices. Sun Aero Motors & Supplies, 10529 Gratiot, Detroit, Michigan.

FOR SALE: J6-9 motor, Lycoming motor, cracked up Laird; artificial horizon. Monocoupe and Fairchild parts. Aircraft Sales Co., Roosevelt Field, Mineola, New York.

SALE: Avro Avian parts; front spars, new, $15. Wanted: Ships to sell, $800 or less. Earl E. Bach, Philadelphia Municipal Airport, Philadelphia, Pa.

LYCOMING MOTOR R-680: Majored, like new, $675. Propeller, perfect condition (Lycoming), $175. Empennage, SM8A Stinson, like new, $60. Tail wheel assembly, less tire, $25. 2 oleo struts, $17.50 each. Right and left landing gear V's, $20 each. Wing struts, uncovered, $20 each. Lou Foote Aircraft Co., Hangar A, Love Field, Dallas, Texas.

FLIGHTEX "A" wing covers: American Eagle, Swallow, Travel Air, Waco, etc., $10. Fuselage covers, $12. Others proportionately. OX-5, OXX-6 parts, bought and sold. Ostergaard Aircraft, Parr, Indiana.

30 x 5 WHEELS, $15 pair; tires, $2. New plugs, B. G. 4A, 50c; Gipsy, $1.50; B. G. 5BI, $1.50; Eclipse direct electric for J-5, Lycoming, etc., $95. Bijur electric for J-5, $65. Electric inertia for J-6 Wasp, $80. 2 9-cyl. Heywood starters, complete, $75 each. New J-5 exhaust manifolds, $35. J-5 Ireland rudder, $10. Kinner K-5 heads, front exhaust, $32. Crankshaft, $15, valves, $4.50. Pioneer compasses, $6. Tachometer, $10. Sperry Horizon, $250. Directional Gyro, $225. Engines: Szekely, $150; Wasp B, $500; Cyclone 1750ce, $500. Irving seat packs, $75. Fairchild 71 parts: fuselage, tail, landing gear, wings, gas tanks, etc. 2 sets 5400 floats. 3 Wasp B props, $100. Electric starter, $100. Generator, $50. 12" brake set, complete, $15. Flare brackets, $10. Swallow parts, wings, etc. J6-9 speed ring, $25. If you don't see it, write Aircraft Salvage Co., 48-03 Ditmars Boulevard, Astoria, L. I., New York.

SZEKELY MOTORS: New, in crates; Lambert 90 h.p., 350 hours since new, just overhauled, complete with Hamilton steel prop.. J-5 Standard cylinders, 370 hours; Velie, 292 hours, 76 hours since last overhaul. Two Inverted Cirrus, 5 hours and 12 hours since new. Sun Aero Motors and Supplies, 10529 Gratiot, Detroit, Michigan.

CRACKUPS: LeBlond NB-3, $85. OX-5 Swallow, $45. Ships eligible for license with approved repairs. 16 x 7 x 3 Airwheels, complete, $20. B. K. Smith, 1453 Barnesdale St., Pittsburgh, Pa.

TRY OUR WING EXCHANGE: You can trade your wrecked wings on rebuilt ones for as low as $30. N. L. Aircraft Co., Vermilion, Ohio.

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● MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

AIRPORT OPERATORS: We are distributors and have in stock new Taylor Cubs available for demonstration and delivery to your customers. Sign up for agency now. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

PAY ONLY $3.50 per hour solo; $5.50 dual. Fly new equipment, open or closed type. 10c carfare from Grand Central. For full particulars, phone Edwards Flying Service, Flushing Airport. INdependence 3-4843.

WANTED: Young man to become manager of established airport. This is your chance to get into aviation. For information, write Max Conrad, Notre Dame, Indiana.

AERONAUTICAL ENGINEER: 10 years' experience designing airplanes, engines, has revolutionary design for airplane in $1,000 field. Partner or group with capital wanted for manufacturing. Unusual profit possibilities. AERO DIGEST, Box 2058.

HAVE YOU AN INVENTION? Want to know how to develop them? A novel invention may produce something salable. Secure patent protection. Write today for my free book "Patent Guide for the Inventor." It illustrates scores of inventions, many of them the foundation of commercial success. Clarence A. O'Brien, Registered Patent Attorney, 314-F Adams Building, Washington, D. C.

WONDERFUL OPPORTUNITY for pilot owner of three- or four-place pontoon ship. Exclusive monopoly of finest resort section in state. Assured work every day hopping passengers and charter trips. I have seaplane base, will pay all expenses of ship while operating, furnish living quarters, advertising and send check for gas to come here. Divide profits. C. Roy Teller, Eveleth, Minnesota.

REAL CONNECTION for a proven airplane ride salesman. Must be hot. 12221 Whithorn Avenue, Detroit, Michigan.

THE BENNETT PLAN places new airplane in operation for you. Ideal for flying clubs, also for pilots wishing to start in business. Little or no capital necessary. Write Bennett Air Service, Hightstown, New Jersey.

AIRPLANE CORPORATION with trained personnel and airplanes desires lease on airport or hangar to manage and establish an operations and repair base. References exchanged. AERO DIGEST, Box 2052.

FOR RENT: Airport. 2 miles from Flint, on good paved highway. Perfect landing field. City needs good school. Owner on premises. Charles Kelley, Route 1, Flint, Michigan.

FOR SALE: Established, licensed field; good location, no competition, with modern steel and frame hangar, shop, recreation hall, restaurant and office complete. On United States Route. 5 miles from city of 12,000 population, Southern West Virginia. Equipment consists of two Waco cabin planes. Jacobs and Continental powered. one Waco F. Warner-powered. and one N-B Trainer. all in first class condition mechanically and otherwise. Address AERO DIGEST, Box 2049. Priced right to sell.

PILOTS EARNING $40 to $100 weekly. We train you and help start you in business. Only men and women of good character need apply. References required. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

RESPONSIBLE CORPORATION having personnel and equipment desires special advertising contracts; or can handle any other work requiring use of aircraft. Would consider work in Central or South America. Can furnish bond and references. AERO DIGEST, Box 2053.

LEARN TO FLY: Near New York City and the seashore. $50 to solo; transport course, $880. LC and private, $250. Amateur, $175. New airplanes. Best instruction. Central Jersey Airport, Hightstown, New Jersey.

HERE IS THE ANNOUNCEMENT we told you to watch for in this issue: Heart of the Lakes Airways, now Wisconsin Dells Airways, has arranged with the Hotel Dellview, Wisconsin, most complete resort, to offer licensed pilots half rate on rooms. Write hotel manager for courtesy card entitling you to this discount. State license held and serial number. Special service rates at Airport for holders of courtesy cards. Wisconsin Dells Airways, Inc., Lake Delton, Wisconsin.

S. A. T. R. PILOT will teach blind flying. Have Stinson equipped hood, instruments, and radio. Communicate with Jack Kelly Flying Service, Central Airport, Camden, New Jersey.

NEW YORKERS: Learn to fly successfully at a convenient price. See me in person at 251 East 31st Street, New York. Ask for Louis, 8 to 9 p.m.

● PARACHUTES FOR SALE

PARACHUTES: Approved types; bought. sold, exchanged. repaired, packed, rented. Specify fully requirements. Airports should investigate drawing power of balloon and inexpensive operation for Sunday business. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

TWO EXCELLENT RUSSELL parachutes: 24-foot seat pack. pure white silk. including carrying bags. for quick sale, $50 and $60 each. Unpacked for your inspection. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

FOR SALE: Parachutes. Four. used: Irving Training. like new; Triangle Training: Russell Lobe. 28 ft. seat; Irving 24 ft. seat. Bargains. S. E. Allen, 6024 S. Cicero Ave., Chicago, Illinois.

IRVIN PARACHUTE: 24-foot seat pack. white silk. fine condition. complete with carrying bag. Bargain. $70. Will ship subject to inspection. Michigan Aero Motors, Jackson, Michigan.

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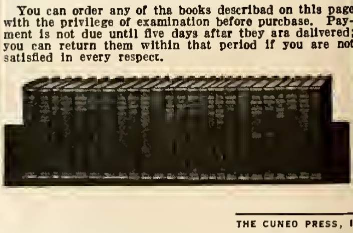

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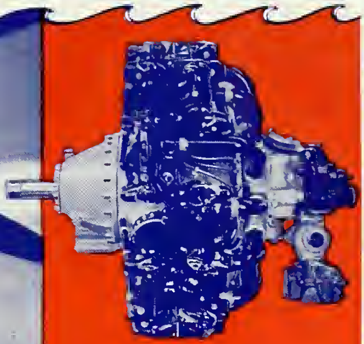

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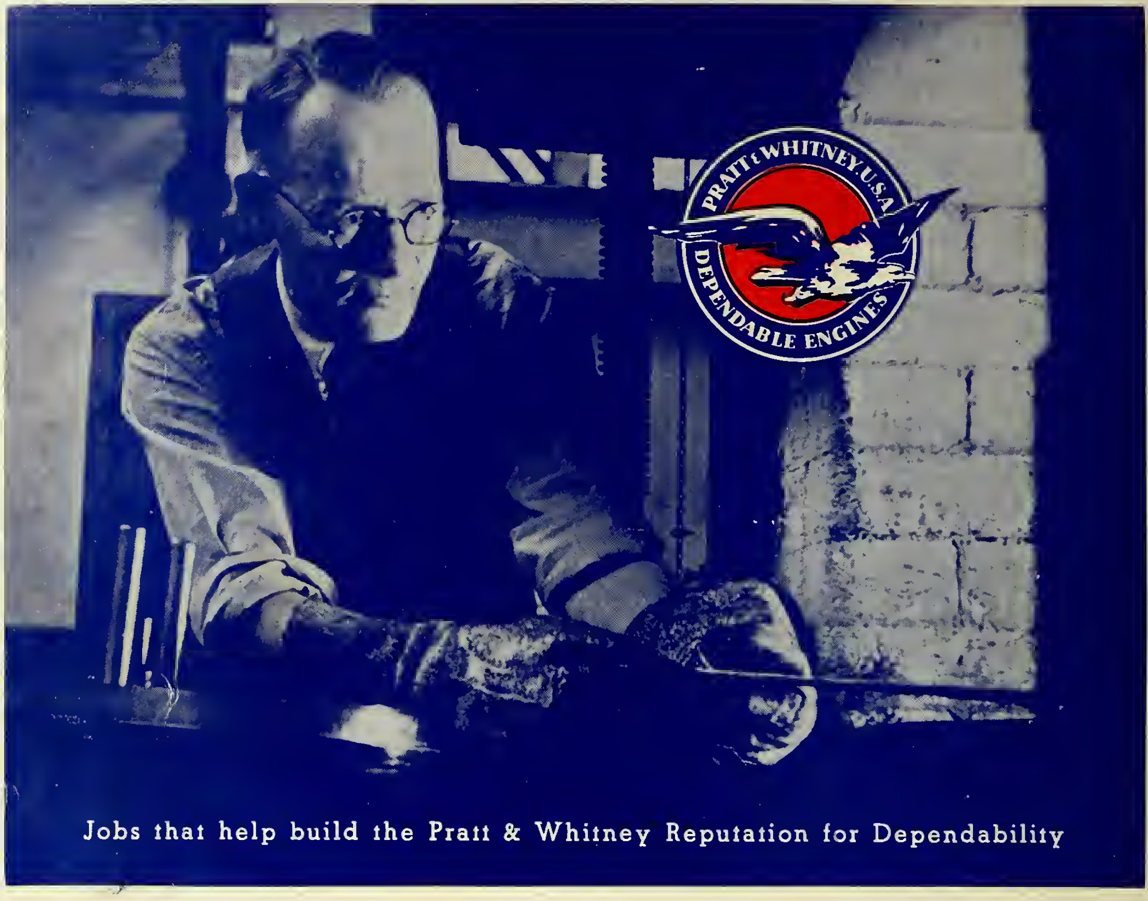

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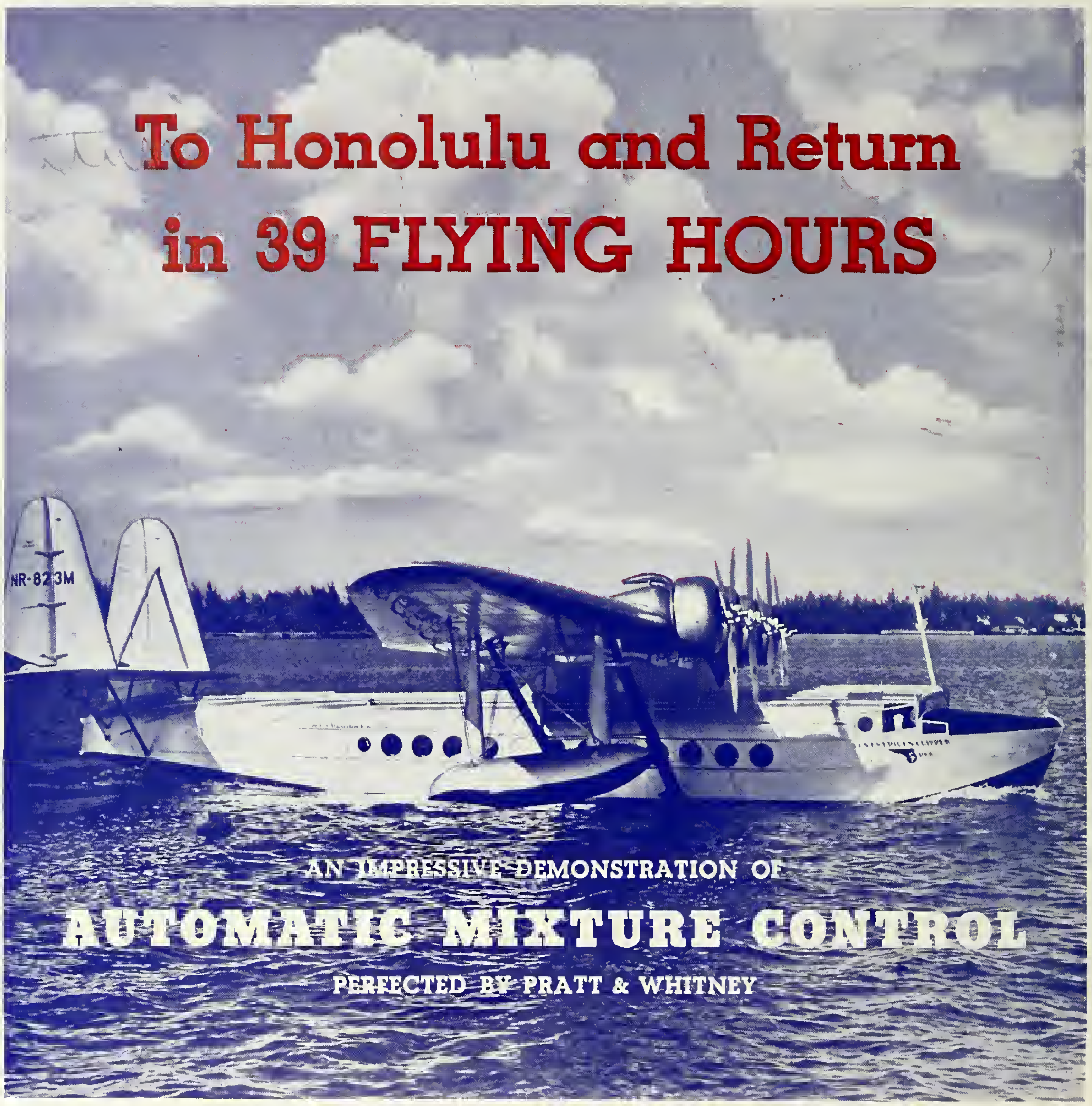
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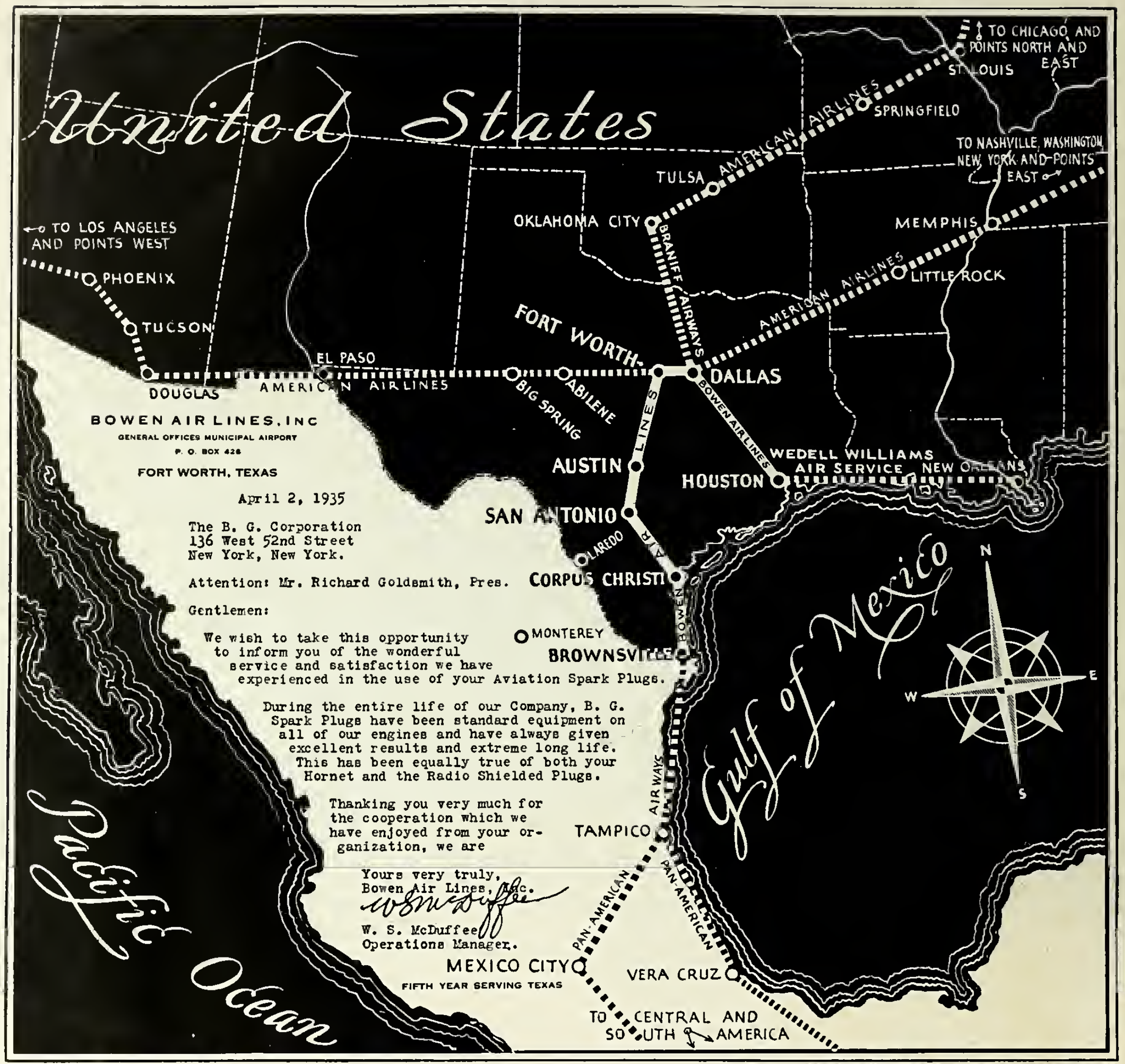

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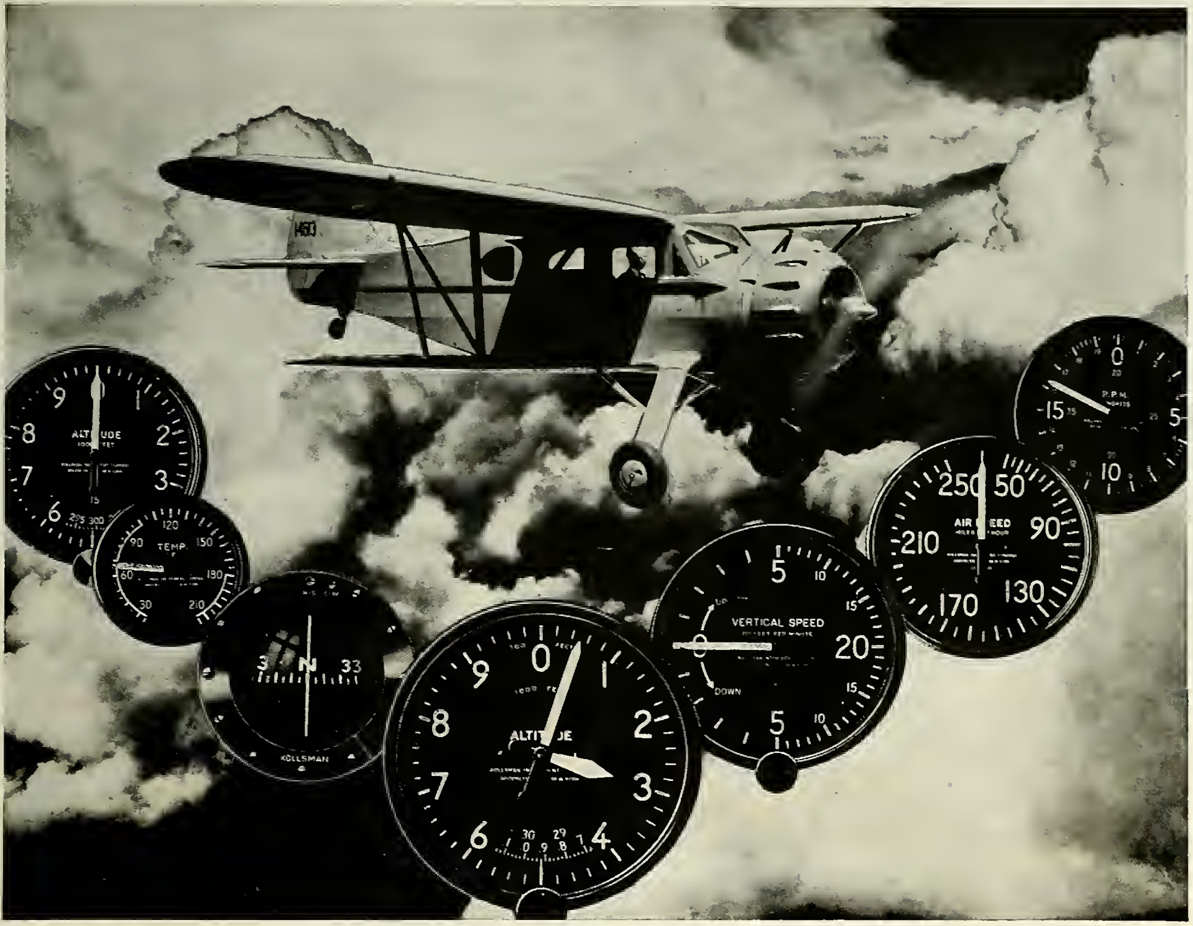

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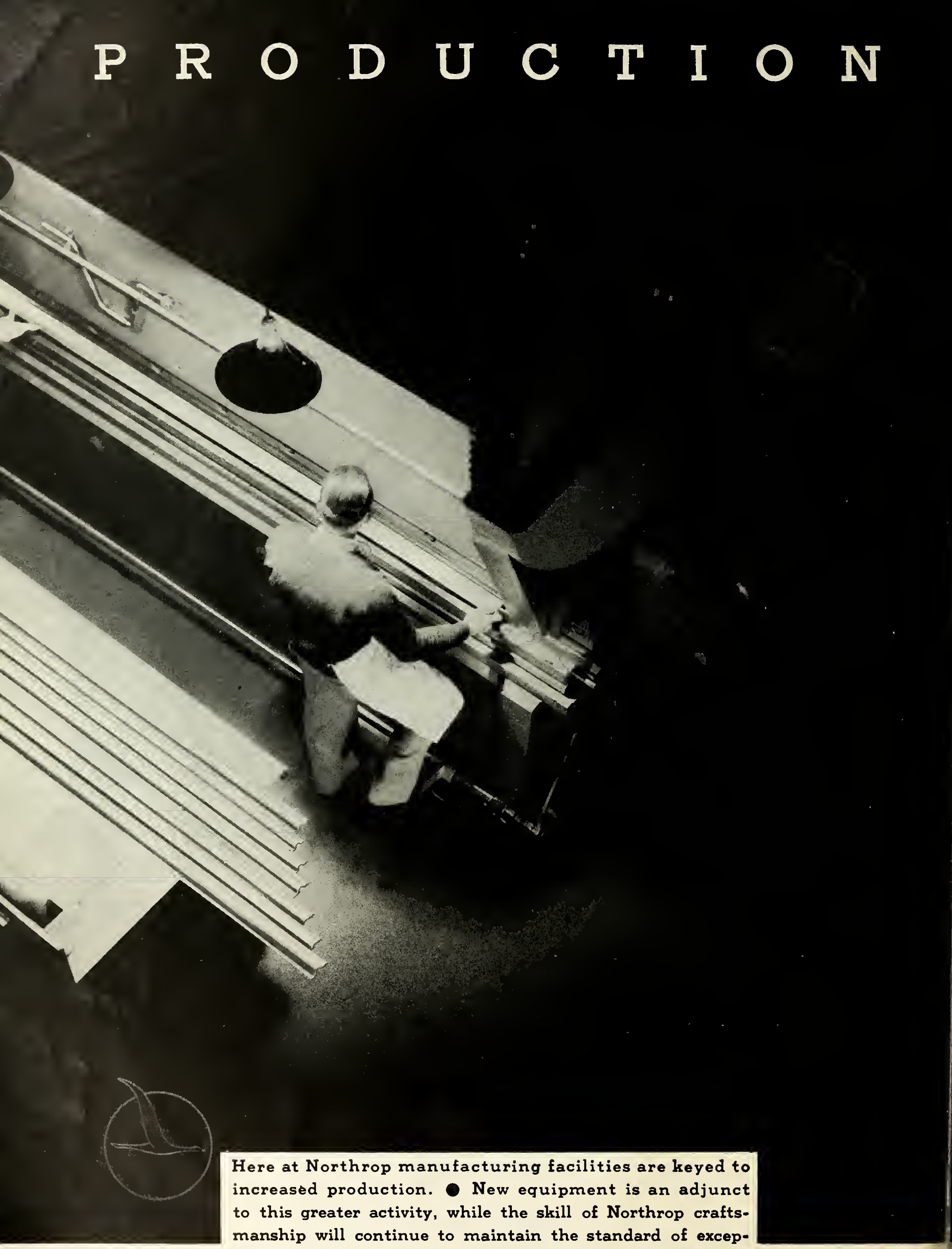

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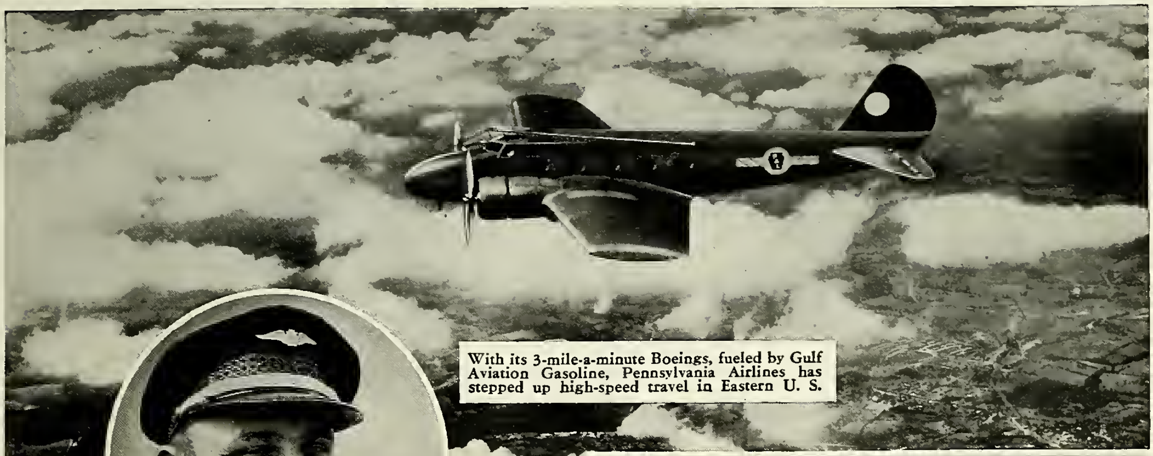

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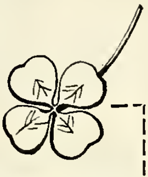

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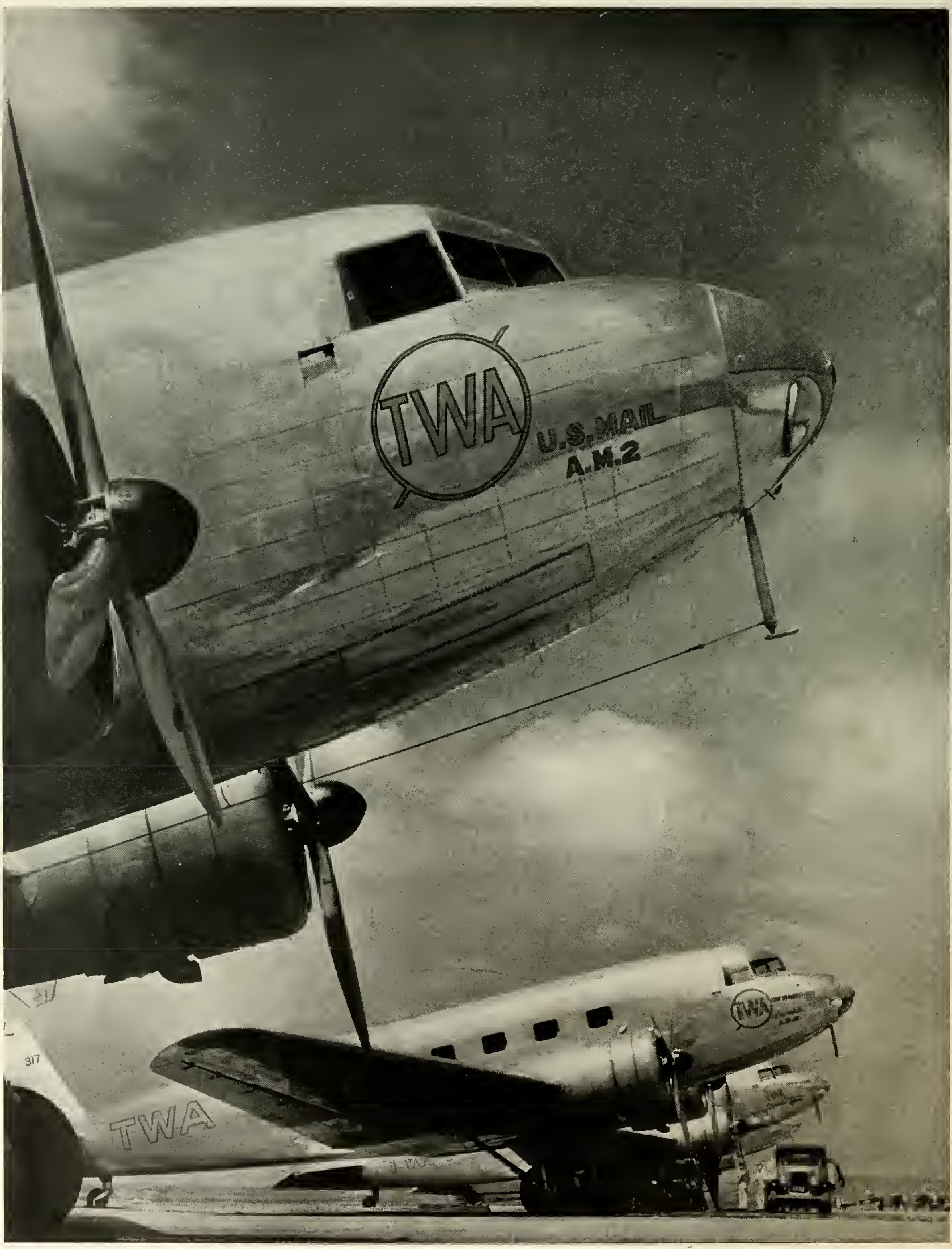

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Four of TWA's twenty-eight Douglas Luxury Airliners which link Los Angeles with New York within 15 hours

AIR

HOT AND OTHERWISE

Five Billion Dollars for Relief! How Much for the Reserves?

FRANK A. TICHENOR

● While the Administration fiddles the World piles up fuel for a mighty conflagration. The Germans are openly building an immense air force. The British are matching them plane for plane, pilot for pilot. And the Russians, the French, the Italians and the Japanese are all racing to stay in the lead.

But what is America doing? Nothing but making gestures of providing an adequate national defense of the air.

To be sure, for its size, America's air force is probably more efficient and effective than any in the world. Poorly trained pilots in dilapidated crates could never have carried out those magnificent maneuvers with the Fleet in the Pacific last month. A loosely knit, haphazard organization could never have despatched 46 flying boats in formation to an objective 1,200 miles over water, with the surety not only that they would get there but that they would strike a blow at the "enemy" just when and as they were scheduled to strike that blow.

But a performance like that can be really dangerous to the nation's safety—the very fact that this maneuver was carried out so splendidly may lull us into a false sense of security. For if war comes we will need not a mere 46 planes capable of such a tactical operation, but 46 times 46.

Those planes and those pilots—yes, all the planes and all the pilots in the Navy and Army air services combined—are but a nucleus around which to build our air force in time of war. Every man who flew a wing position over the Pacific last month will be needed as a squadron commander. Where, then, are we going to get the men to fly the positions they will vacate? Where are we going to get pilots with military and naval flying experience who can jump into the breach with a minimum of delay? There is only one answer—from the Reserves.

The Body and Brawn of Our National Defense

Let there be no mistake about it—the Reserves are one of the most vital organs in America's national defense. When war comes, the regular Army and Navy will be the heart to pump life into our air force and the head to guide it. But the Reserves will be the body. And it is in the body that we must build the brawn that can strike with knock-out force. It is in the body that we must develop the sinew and the stamina that can stand up and take it when the enemy strikes.

But is the Administration building up that body, is it strengthening those muscles? No! It is dawdling around reciting pretty paragraphs from a correspondence-school course on "How to be Hercules in Ten Easy Lessons." Then, to prove the efficacy of these recitations, it does a few lackadaistical setting-up exercises that wouldn't harden the biceps of a pee-wee.

While the Nude Eel is lavishing billions on boondoggling, it makes the generous gesture of appropriating a paltry $308,000 for Air Corps Reserve equipment. While our British cousins undertake a program to train 2,500 R.A.F. pilots and 20,000 ground technicians, our Navy is granted permission to train a mere 500 Reserve aviators. And while thousands of virile young college graduates grow despondent roaming the streets looking for work, the gates of Randolph Field are closed to all but a trickle of cadets from civilian life.

Aviation Commission Found Reserves in Bad Shape

The Federal Aviation Commission made an exhaustive study of the Reserve situation, and found it in deplorable shape. They reported that the Navy has only 251 Reserve officer-pilots ready and fit "to step directly into tactical organizations the day of a declaration of war." The Army has only 1,450 Group I Reserve pilots, whose fitness for immediate combat duty is exceedingly dubious at that. Not because of any deficiency on the part of the Reserve officers themselves, but because the Air Corps Reserve has always been the orphan of the service. Funds for the Reserve have been so stingily granted that Reserve officers are restricted to four hours' flying a month. Moreover, they are compelled to do that flying in old, cast-off equipment and are forbidden to fly over a hundred miles from the home base. (In case of war, we hope the enemy will be considerate enough to withhold any attacks until within a hundred miles; our boys might get lost flying to the defense of some city a thousand miles away.)

These are facts as the Federal Aviation Commission found them. In the face of such deficiencies, that erstwhile body could not have done otherwise than it did—recommend that immediate steps be taken to correct them. Today, with the world seething with built-up air forces, the need is far more urgent than when the Commission made its report. Yet here, nearly six months later, little or nothing has been done.

Two Great Sources of Unused Reserve Material

It is not really *doing* something to increase the Naval Aviation Reserve by 500 when it is 5,000 that is needed. It is not *doing* something to allot $308,000 to new equipment when $1,308,000 would only begin to be enough.

Why doesn't the Administration take advantage of the presence of those thousands of recent college graduates by putting them through a course of Reserve flight training during the period of their unemployment? They would eagerly jump at the chance. It would keep them usefully occupied. It would raise their morale to new heights, where the only alternatives—the dole, work-relief or straight, unmitigated unemployment—would plunge it to the lowest depths. But far more important, it would provide the nation with a backbone of national defense which would endure for years.

Again, why doesn't the Administration take advantage of the 10,000 or so licensed private and commercial pilots who already know how to fly? In the event of war, it would take months of valuable time to whip them into shape as useful military personnel. If they were indoctrinated in military and naval aviation tactics in peace time, however, they could be made into a first-class fighting machine in short order when the call to arms came.

The Federal Aviation Commission specifically recommended that the Government should not let this valuable Reserve material stand idle. Thus far its recommendation has been ignored. Why? Is it possibly because Reserve officers may be excellent national defense material, but are poor political material?

C. G. Grey's Great American Airway Bluff

CY CALDWELL

The British magazine "The Aeroplane" is featuring a series of articles on American aviation by Cy Caldwell under the title of "What Cy Says." Inasmuch as the accompanying article is also "What Cy Says" it is respectfully submitted to the editor of "The Aeroplane" with permission to reprint it in its entirety. A most appropriate title would be "Cy Also Says—."

● Standing on his head again (and thus elevating his brains above their usual altitude in the editorial chair-seat) my good friend the eminent C. G. Grey, Editor of the *Aeroplane* of London, takes pen in hand to indite a diatribe against his pet aversion—the American transport airplane. Unhampered by the Grey weight, which ordinarily performs the useful function of a steam-governor, the Grey mental machinery revolves at terrific speed, the steam pressure rises, and Mr. Grey blows up in an article called *The Great American Airway Bluff*.

"America's Biggest Bluff at the present moment," he writes, "is the wonderful performance of the American airways. I love a good bluffer . . . They are not even four-flushing; they just have a couple of pairs and they are pretending to have a straight flush. And the documents which have busted the flush come from the Aeronautical Bureau of the U. S. Department of Commerce.

"The figures which appear hereafter are stated officially to be correct up to January 1, 1935, and the Air Ministry Document in which the figures appear states that the details have been taken from the Interstate Commerce Commission, Air Mail Docket No. 1. This shows a considerable decrease in *the operational cruising speeds of the latest types of air transport machine* compared with the figures for January 1, 1934, which were taken from manufacturers' specifications." (Italics are my own.)

Now, what Mr. Grey has done, in his desperate zeal to boost English aeroplanes at the expense of American airplanes, is to take a set of U. S. government statistics and either innocently misunderstand them or deliberately misconstrue them, and thus attempt to deceive his trusting readers in all parts of the world. My appreciation of Mr. Grey as an aviation authority will not permit me to harbor the depreciative thought that, after more than a quarter century in aviation, he still is an innocent; so, in fairness to him, I must conclude that he is trying to get away with the Biggest Bluff that has ever been tried in an aeronautical publication. And, like Mr. Grey, "I love a good bluffer,"—though when I hold a good hand I call him!

The figures which he quotes for the six crack American airlines: Average available payload per machine; average horsepower per machine; and average operational cruising speed of the whole fleet. Mr. Grey quotes the figures correctly, so far as I know, but he neglects to tell his readers how those figures were arrived at and what they mean. Those figures submitted to the Interstate Commerce Commission were based on operations during the three-month period in 1934 during which the airlines were operating under temporary mail contracts. Furthermore, they are only for air mail, not passenger operations. And it will be recalled that during the temporary air mail bill period a good many of the companies—notably Transcontinental and Western Air—were using individual units which carried only passengers, and carried them in equipment, such as the Douglas, which was much faster than the Fords which at that time were carrying mail and some passengers. The Post Office requirements were technically met by any plane which had a speed of at least 110 m.p.h. and provisions for carrying mail. Upon receipt of the new contracts most of the companies not only began carrying mail in their faster equipment, but also let orders for the construction of additional planes of new types to replace the obsolete equipment with which they had obtained their new contracts. The figures, therefore, include *every* airplane that the airlines owned during that period, *whether those airplanes were in service or were stored in hangars as old reserves or were awaiting sale as surplus or obsolete material.* This fact Mr. Grey evidently knew very well, for he says, "We must remember that the fleets of these big companies include all sorts of machines."

C. Grey Grey still writes that way

Then he proceeds to "forget" that important fact. He forgets that the "average operational cruising speed of the whole fleet" must include many obsolete machines which are no longer in service, and says, as I have quoted him in my third paragraph above, "This shows a considerable decrease in the *operational cruising speeds of the latest types of air transport machine.*" It shows nothing of the sort, as Mr. Grey, bluffing boldly, knows full well. It shows *only* that if all the modern airplanes in actual air mail and other service, all the older airplanes used in maintenance and training work, all the older machines held in reserve for possible emergencies such as heavy holiday travel, and all the obsolete machines awaiting sale in hangars were flying (which of course they were not) that the average cruising speed of that heterogeneous fleet would be what the Interstate Commerce Commission said it would be. It has nothing whatever to do with the "operational cruising speeds of the latest types of air transport machine," any more than the speeds of the early aeronautical relics hanging in the Smithsonian Institution have to do with the speeds of the modern air transports flying today on our major airlines. In fact, while he was about it Mr. Grey might have included those sacred relics, thus writing us down still further!

He quotes, for example, "United Air Lines Transport Corporation. Payload, 1,799 lb., h.p. per machine, 759. Operating speed, 121 m.p.h."

Mr. Robert E. Johnson of United Air Lines says: "These statistics are uniformly in error. United Air Lines operates *only* Boeing 247-D and 247 type airplanes. The rated horsepower of these planes is 1,100; the payload of these planes is 2,582 pounds for the 247-D and 2,282 for the 247. The 247-D has an official cruising speed of 189 m.p.h. fully loaded and a top speed of 202 m.p.h. under the same conditions."

Thus, when it is a fact that United Air Lines is using in service *only* Boeing 247-D and 247 types, *and no other machines whatever,* it cannot have "Payload 1,799 lb., h.p. per machine, 759. Operating speed 121 m.p.h." as Mr. Grey states. The *slowest* plane in service on United at the present time is the Boeing 247—with a cruising speed at 5,000 feet of 171 m.p.h. Very soon, however, all of those machines will be converted to the 247-D type, which differs from the 247 in that it is equipped with geared supercharged P. & W. Wasp engines turning 3-blade controllable pitch propellers, and has improved streamlining and cabin soundproofing. United Air Lines has in service 10 factory-built 247-D transports, and 10 more planes of that type which they converted themselves at Cheyenne from the 247 type. They are proceeding with similar conversion of the *entire balance* of their 247 equipment. So within the near future *all* transports on United (and they are *all* Boeings, and there are 55 of them) will be cruising at 189 miles per hour—not 10 Boeings cruising at 121 m.p.h., as Mr. Grey, with his tongue slyly in his cheek, hopes that his readers will believe.

Mr. Grey continues "And there are two older Boeings,—one carries 14 passengers at 120 m.p.h. on 1,575 h.p., and one carries 11 passengers at 120 m.p.h. on 1,350 h.p. There is nothing to boast about in any of those." I should say there isn't! And nobody is boasting about them, either, for, as Mr. Johnson informs us, these ships, "the Boeing 80 and 80-A tri-motored transports *were retired from active service in 1933,* and none of them have been in operation on our system since that time." However, though they are dismantled, they still fly in spirit through the Editorial Sanctum of the *Aeroplane;* their ghosts are haunting Mr. Grey.

After discussing the Douglases and Boeings—including the tri-motored and single-engined Boeings no longer in service (and not in service on January 1, 1935, either, as Mr. Grey would have you believe) Mr. Grey writes triumphantly: "Now compare that bunch with our D.H. 86—that is, the four-motor biplane which carries 12 or 14 passengers, according to the range required, at 147 m.p.h. on about 800 h.p. That is to say, it is about 18 m.p.h. slower than the Douglas and about 15 m.p.h. slower than the Boeing, it has about two-thirds of the horsepower and costs about half as much."

Very well, at Mr. Grey's invitation, let us compare them. But first let us correct Mr. Grey's sly figures, for again he is attempting to bluff us in our innocence, and in our trust in his unimpeachable honesty! The speed of 147 m.p.h. for the D.H.86 is 2 m.p.h. more than the cruising speed Mr. Grey himself allots it in *Jane's All the World's Aircraft,* of which also he is editor. But let that go—what is a mere couple of miles per hour between friends? However, after writing his D.H.86 *up* 2 m.p.h. he writes our Boeing 247-D *down* 27 m.p.h.—and does it without lying a mile! And therein is the Satanic craftiness of the man Grey, the world's greatest poker player, who can draw one to a busted flush and talk as though he held a full house. For he artfully takes the cruising speed of the D.H.86 at 1,000 feet (probably it's most efficient cruising level) and compares it with the official figure of the Boeing's cruising speed *at sea level,* its most inefficient altitude. He ignores the fact that our American airlines, after exhaustive experiments, have found it to be practically impossible to fly from New York to San Francisco at sea level. They discovered, to their consternation and chagrin, that between New York and San Francisco lie several ranges of mountains, some of them over 10,000 feet high. So they gave up trying to fly across the continent at sea level (which would have necessitated tunnelling nearly all of the way) and bought a machine whose most efficient cruising speed is at a height sufficient to clear these natural obstacles—12,000 feet. And at 12,000 feet the Boeing 247-D cruises at 189 m.p.h.—not 162, as Mr. Grey wants you to believe. I mean, if you're going to compare machines as to cruising speeds, it is obviously unfair to take the speed of the one at its most favorable altitude and take the speed of the other at its most *un*favorable altitude. Fair is fair, even between an English editor and an American associate editor, and even between a couple of termites, or two downy-breasted wood-peckers.

The American all-metal Boeing 247-D

Pride of British airlines, the D.H. 86

Now let us go about this comparison—after correcting Mr. Grey's statement that there is a difference of only 15 m.p.h cruising speed between the Boeing and the D.H.86. There actually is a difference of 42 or 44 m.p.h., depending upon which of Mr. Grey's figures for the D.H.86 you prefer—those in the *Aeroplane* or those in *Jane's,* both of which are his.

The D.H.86 has a little over two-thirds of the Boeing's power, and goes 42 or 44 m.p.h. slower. How much more power (I am not an engineer) will it take to make the D. H. 86 go as fast as the Boeing 247-D? My guess is that it will not do it with only 300 more horses. In other words, if Mr. Grey wishes to make his D.H. go as fast as a Boeing he will have to use more power than the Boeing is using now. And my reason for that guess is that the D. H. 86 is a mass of struts, wires, wings,—four of them—wheels, and engines—four of them—and while the whole weird collection cruises along well enough on 800 h.p. at 145 m.p.h. it is going to take all the King's horses and many of the King's men to make it go 44 m.p.h. faster. And if *that* is a bluff, Mr. Grey should throw his warped slide rule in the pot and call me!

". . . and costs about half as much," says Mr. Grey happily, about the D.H.86. Well, why shouldn't it cost about half as much? It's only about half as much aeroplane, as one can see by looking at it. Quoting now from *Jane's* for both machines (and this is Editor Grey's description, not mine) the Boeing fuselage is: "Semi-monococque structure of duralumin members and bulkheads, with aluminum-alloy skin." Modern construction, you see. The D.H.86, on the other hand is; "Fuselage—Wooden box structure with spruce members outside skin of

(*Continued on page* 78)

EDITORIALS

"A delay-cost chart prepared to combat a prevalent popular notion that air lines easily can make up a few minutes lost time and will gladly hold up scheduled departures for a passenger who is late, shows that arriving on time at the end of a 200-mile flight after taking off six minutes late, costs the air line $13 in additional depreciation and fuel consumption, or the entire revenue derived from a one-way ticket."—EDMUND T. ALLEN, Chief Engineer, Eastern Air Lines.

Government-Sponsored Flight Instruction

● One bill now being considered by the House Military Affairs Committee is worthy of a better fate than most bills designed to give this country a reserve air corps personnel which will bolster our inadequate flying forces in an emergency.

Congressman McGehee's measure carries even further than that. It will, if passed, open a new approach for the instruction of embryonic pilots and put to work many of our unemployed Reserve Air Corps officers.

Briefly, this bill asks $1,175,000 for flying equipment for 48 Land Grant Colleges and Universities, each so strategically located that rapid expansion in flying instruction and mobilization of flying personnel may be carried on in an emergency. The Secretary of War will be empowered to administer the provisions of this act, supplying the equipment and providing regular Air Corps officers as supervisors. Instruction will be given by government-approved Reserve Air Corps officers who will be paid by the various institutions, which also will hire and pay mechanics and other necessary personnel to care for the flying equipment loaned to them by the government. Students will be allowed a maximum of 200 hours flying time in four years, the only cost to them being the fuel and oil they use.

If put into law this bill will provide flying instruction under military supervision to students at a minimum cost to the government; maintain a number of Reserve Air Corps officers at a high state of flying efficiency; give the Army and Navy air forces a group of civilians who, with little additional training, could be made into an effective military personnel; and provide a number of training bases whose value in an emergency can hardly be calculated.

Most bills as constructive as the McGehee proposal usually are killed in committee. This one, however, should receive more thought and concentration than others. With a man of Congressman McSwain's stature at the helm of the House Military Affairs Committee, we can be assured that it will get every possible chance of running the gauntlet of a vote by both houses.

The United States should not remain lackadaisical in any extensive effort to build up a force which is numerically superior, if not equal to any in the world—today or in the immediate future.

The passage of this bill will be an initial step in the right direction. Once started every effort should be made to keep us foremost in military aviation.

Get Behind Air Express

● An incongruous feature about the healthy progress made by air express is that the aviation industry itself has been its most infrequent user and weakest booster. Yet, that branch of the industry did remarkable work in tiding over the airlines during the dark days of the Farley-McKeller-Black plague and cancellation period last year. And since that time air express contributed substantially to the air transport coffers, and has helped heal some of the injuries caused by the epidemic of sacrificial mail bids.

There is an opportunity for every company in the aviation industry, and for every company which serves or supplies it, to profit through the more extensive use of air express which has dependable and nationwide service available at reasonable rates.

An immediate benefit from the use of air express comes from speeding up business. It accelerates production, engineering and purchasing, increases sales and gives better service to customers or clients in other businesses. It can do the same for the aviation industry which can also help air express by selling the idea to the executive, financial, legal, sales, advertising, engineering and purchasing departments of other companies, particularly those with which it does business.

The low unit cost of an air express shipment makes possible broader use by the general public when they are informed and reminded of its advantages.

Perhaps being so closely connected with a utility has misled us into believing that the most enthusiastic acceptance of this service should come from outside the family. Air express deserves the backing of the industry not only because of its unlimited possibilities, but because it is the silent, yet one of the most effective salesmen of the speed, safety, and dependability of our airlines and aeronautical equipment.

Millions For Air Forces

● The sum of $323,000,000 for new aircraft equipment! Five major countries originally planned to spend that magnificent sum during 1935, but now that Germany has made startling military proclamations, especially in regard to her air power, it can be expected more will be appropriated on all sides in an effort to provide further security in the air.

Italy was to place $100,000,000 at the disposal of her aircraft industry; Germany had $83,000,000 set aside; France, $65,000,000; Great Britain, $55,000,000; and Japan, $30,000,000. Russia, with one of the world's largest air forces, made no public announcement, but her factories are known to be producing military planes at a rapid rate.

The world has the realization that air power is an ascendent force. Without it no nation can hope to keep her borders safe from ambitious hosts. Even with it, unless that power is numerically strong, mechanically efficient and manned by trained military fliers, they stand little chance of survival should war break out again.

And so the arms race is under way, with all eyes centered on the airplane. The military flying machine has come a long way since Orville Wright demonstrated his army aeroplane before President Taft in 1908, resulting in the appropriation by Congress three years later of $125,000, the first money to be voted specifically for aeronautics.

Aviation Versus the Medical Profession

● While governmental regulations of amateur pilots have been tempered recently, more can be done to encourage new pilots into the ranks of the private owner.

One of the first irritations encountered could be eliminated by modifying the student's physical examination and the excessive fee charged therefore.

Many young men would consider taking flying lessons if some of the medical red tape connected with a student permit was reeled in. A physical examination when he is ready to apply for his private pilot license would be sufficient safeguard to all concerned.

Cooperative Effort in Selling to the Private Owner

CHARLES J. CUTAJAR

Mr. Cutajar is well-known as an advertising and marketing counsellor, and authority and author on problems affecting the aircraft market. AERO DIGEST readers will remember his series of articles on aircraft marketing published during the latter part of 1933.

● Startling developments have been promised in aircraft design for the individual owner and it seems that these new possibilities are not only greater in variety and number today but are much nearer realization. Other favorable influences are also at work to advance the sale of airplanes to private owners. The public is being brought closer to aviation—by travel on the airlines, by education in the schools, by flying clubs and organizations, by the increasing amount of material appearing in the newspapers and magazines and by the growing interest of women in flying.

Some of the pin pricks are losing their severity—the governmental restrictions and regulations, the cost of flying instruction, the expense of insurance—these things are becoming more sensibly adjusted as time goes on. The cost of operating a private plane has been greatly reduced. Stocks of surplus equipment are no longer excessive.

With all these encouraging factors, it is somewhat deflating to consider that there are but 2500 privately-owned planes in the country, according to estimate of the Federal Aviation Commission. While there was a nice gain in sales last year of about 33%, and a somewhat similar gain may be expected this year, the industry is still operating within narrow limits and serving a restricted market.

The sales horizon, therefore, should not be confined to the immediate prospect, however promising it may be. Sales policies and sales promotion must build, from a practical standpoint, not only for the sale that can be made now but for the greater opportunity to come. Up to now the market has been gradually broadened by dint of hard work, by increasing selling efficiency and by constantly improving and refining the product. But with all the progress that has been achieved, the big job yet remains to be done. It is a job for both the engineer and the salesman.

Engineers know that the result of any endeavor is directly proportional to the force applied, and inversely proportional to the opposition encountered. Think of that in terms of selling. In a whole industry to gain sales and make progress the force of selling must be capable of overcoming the mass resistance of the buying public. And the resistance encountered by the man who sells airplanes would break the heart of even a man who can still sell second mortgages on country estates.

If some aircraft salesmen seem to be enjoying life, it is only because the aircraft salesman is a pretty hardy citizen. And he has to be. He must look longer, harder and further for a solvent prospect than Diogenes had to look for an honest man. He must dispense joy hops with the free hand of a political candidate handing out campaign cigars. He must collect certified checks for substantial sums as inevitably as the hat check girl collects dimes. He must know as much about the weather as Dr. Kimball—as much about the intestinal fortitude of the prospect as a psychiatrist—and as much about aerial showmanship as the man on the flying trapeze.

We cannot look to the salesman to put forth greater effort, but we must find a way to reduce appreciably the mass resistance which he encounters. This calls for advance work of a more effective kind and on a larger scale than heretofore. This is the big job referred to. It is one that is too big for the individual manufacturer to undertake. Rather, it is a job for the industry as a whole.

The suggestion of some kind of a cooperative effort in this respect is not new. It has been discussed many times. That no steps have been taken is probably due to the economic situation prevailing in recent years. But no informed person today doubts that, from now on, an increasing number of airplanes will be sold for private and business ownership. It is pretty well agreed that the industry is going forward, and if this is so, there is no sound reason why steps should not be taken at once to crystallize favorable public sentiment and develop new prospects on a scale greater than any undertaken heretofore.

We have many precedents of cooperative endeavors by whole industries —successful ones. The technique is established. The mechanics are simple. Whether or not the effort in the beginning might take the form of market research, of distribution of literature, of advertising, or of some unusual promotional activity, is a matter which could be left to some competent committee. Whatever the activity, its primary object should be the disclosure of interested prospects who respond to the impartial approach, but who coyly refuse to expose themselves to the recognized salesman.

One need, as I see it, is for an organized propaganda bureau to stimulate activities that bring private flying to the favorable notice of the public, and to disseminate information that will lead to a better understanding of the advantages of owning an airplane.

A second need is to find more ways of identifying likely prospects. Of the airplanes which will be purchased for pleasure and for business use this year, far too many will be by people who have owned planes in the past. The recruits are too few. One reason for this is that unless the prospective purchaser actually comes to the airport and starts asking questions, he usually remains pretty well obscured.

In other fields prospects are comparatively well defined, and they can be brought down with a rifle. But when we attempt to promote the sale of aircraft we have to fire into the trees with a shotgun and hope for results. That is, unless efforts are confined to the narrow circle of identified prospects with the chance of getting trampled in the rush to reach them first.

Now it is very, very expensive to use a shotgun in selling or in advertising. Even the biggest advertisers use rifles, although they may be 8-inch ones. Certainly, no individual airplane manufacturer today can afford to scatter his shot. And so there is very little firing done, except in the advertising columns of the aeronautical publications. These are undeniably the most effective media for the present, though somewhat restricted in coverage when it comes to expanding a consumer market in a country such as ours.

It is true that to a degree, it is possible to identify prospects for *business* ownership of airplanes. But whereas a recent survey showed that air travel to an aver-

(*Continued on page* 76)

Langley Field Engineering Conference

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New York University

● The Langley Field Conference was as in previous years, successful, interesting, and attracted an attendance that was probably greater than in any year since the depression. After the general meeting in the morning and the subsequent visits to the laboratories, a series of five special conferences were held dealing with such topics as high lift devices, propeller vibration, compression ignition engines, aero-dynamic interference, etc.

A Free Spinning Tunnel

Visitors were impressed by the free spinning tunnel, recently completed and patterned after a similar tunnel at Farnborough, England. The tunnel is vertical and of the double type, as shown in figure 1. Its working portion is a cylinder 15 ft. in diameter and 27 ft. high, The air, drawn upwards by an electrically driven propeller, returns through a circular screen at the lower end of the cylinder and its speed can be varied between 15 and 50 ft./sec. At the top, an observation platform is built round the cylinder, to which approach is made by a staircase in the return section. Models are constructed of balsa wood, with a span of 2½ to 3 ft., and are ballasted to give the same moment of inertia distribution as in the full scale machine. They are equipped with clock-work mechanism which can be made to actuate rudder or elevator, or both, through varying angular displacements, after varying periods, and with different rates of actuation.

The technique of experimentation is simple. The model is pivoted at its center of gravity on a spindle attached at the end of a long pole, which is inserted into the tunnel. Under the action of a displaced rudder, the model assumes a certain rate of spin while exposed to the rising current of air. When the airspeed has attained a sufficiently high value the model rises from its spindle in a spinning attitude, and remains hovering in the airflow. The vertical velocity of the air then represents the rate of descent in a spin. The model continues to spin about the axis of the tunnel, and does so with remarkable regularity. When the rudder or elevator is displaced by the clock-work mechanism, the model, if it recovers from the spin, goes into a nose-dive, and is caught in a netting placed below the experimental section. Visual and moving picture methods of observation are employed. Thus a quick, practical method of answering the question, whether or not the model will recover in a given spin becomes available. The technique should be extremely useful in a designer's approach to the spin. Of course, certain discrepancies exist owing to scale effect between the model and the full flight behavior, with closer agreement at higher angles of attack, but these differences are not large enough to invalidate the utility of this method of investigation.

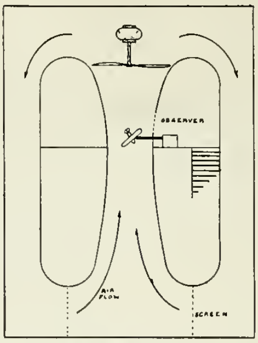

Figure 1. Vertical spin tunnel at Langley Field, Virginia

Boundary Layer Control

An extensive series of experiments has been made on boundary layer control. Tests were made on a stub wing of low span, and maximum thickness of 30%, and on a normal wing of 15% maximum thickness. Tests on the stub wing indicate that the suction method of drawing in air is superior to the ejection principle, and that single slots are more effective than multiple slots. The results were more favorable with the stub wing than with the long span wing of conventional practice. In the long wing there is uneven distribution of suction along the span, and flow losses inside the wing become important because of the large volume of air that has to be drawn in. At landing speed approximately 0.5 cu. ft. of air per second has to be drawn in per unit wing area to give a lift coefficient of 3 but to secure this enormous lift coefficient the power expenditure is less than 3% of the rated engine power. The main effect of suction boundary layer control is to maintain the lift-slope curve at much higher angles and to delay the burble. This result applies to both plain and flapped wings. With boundary layer slots there is a slight increase in minimum drag, but the main difficulty seems to be that in order to secure very high lift coefficients, the angle of incidence must be well over 30°, an attitude which is difficult to secure in either landing or takeoff, particularly the latter.

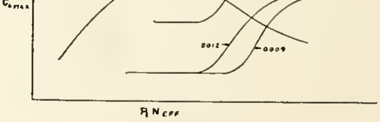

Figure 2

Scale Effects on the Maximum Lift Coefficient

One important result in scale work has been arrived at during the year: there is practically no scale effect in flap action. The maximum lift coefficient plotted against the Reynolds Number is shifted parallel to itself by split flap application. Therefore if the scale effect on maximum lift for a wing section is known and the lift increase due to flap depression is determined at any one Reynolds Number, the maximum lift at any R. N. can be readily predicted. (figure 2)

Figure 2 also shows that scale effects on maximum lift vary for different wing sections. Thus the thick NACA 8318 soon reaches a critical point beyond which the maximum lift coefficient actually decreases, while the thinner sections continue an almost indefinite increase. The supposition can be made that they also will finally attain a critical point beyond which the maximum C_L will either decrease or remain stationary. The effect of scale on maximum lift is closely associated with the pressure distribution as has been pointed out by the writer in AERO DIGEST a year or two ago.

A departure in presenting data on airfoils will be made shortly by the introduction of a *Turbulence Factor* by the Bureau of Air Commerce. A sphere tested in the tunnel will reach a certain critical value of its drag coefficient at a higher value of the Reynolds Number when the turbulence in the airstream is low. It is also recognized that turbulence and the Reynolds Number act substantially together in increasing the maximum lift coefficient and delaying the burble. From these considerations an effective Reynolds Number will be introduced which will be the product of the R.N. by the Turbulence Factor. In free flight the Turbulence Factor will be 1. If results are obtained in the huge full scale tunnel, the turbulence factor will be 1.1 and the Reynolds Number will be multiplied by 1.1 accordingly. If results are obtained in the highly turbulent variable density tunnel, the Reynolds Number will be multiplied by 2.704. For the ordinary atmospheric tunnel a similar factor can be introduced by checking its turbulence by means of the sphere test. When maximum lift coefficients are plotted against the Effective Reynolds Number results obtained in various tunnels fall on a very smooth curve. Therefore a definite step forward has been achieved in obtaining correct values of maximum C_L.

At the same time this method introduces an error in the estimation of the minimum drag coefficient. While the introduction of turbulence increases the Effective Reynolds Number as far as maximum lift is concerned, the drag is unduly increased. Therefore a correction has to be made by theoretical calculation to secure the drag at the corresponding R.N. in the non-turbulent air of full flight.

Lift Increase Devices and Lateral Control

Attention was given to lift increase devices, and in particular to the Fowler variable area wing. The Fowler wing (figure 3) secures a greater lift increase than the split or Zap flap, and does so with less accompanying drag increase. Because of its low Lift/Drag ratio when depressed the split flap does not improve the take-off and subsequent climb to clear an obstacle. The Fowler wing with a much higher L/D when extended is much more promising in this regard.

Examination of the Fowler wing as installed on a small Navy airplane showed no insuperable structural difficulties. The auxiliary wing moves on rollers on two curved tracks which are braced from the lower surface of the main wing, and is operated by a push and pull rod. The tracks can be constructed to give different depression angles. Short, wide, balanced ailerons have been used with the Fowler wing, apparently with satisfactory results. Full flight tests revealed drawbacks in stability. With the wing extended the machine is unstable from the pilot's point of view and if speed is increased beyond 50 m.p.h., the pilot has to pull back on the stick to decrease the angle of incidence. The causes of this apparent instability are to be found in a number of factors—c.p. travel on the wing, downwash on the tail surfaces, etc. Directional stability was also poor with auxiliary extended. It does not follow that these undesirable stability characteristics would be found on all ships equipped with this device, but aerodynamic investigation would be advisable prior to its use.

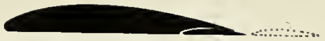
Figure 3. Fowler wing

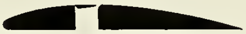
Figure 4. Spoiler and slot

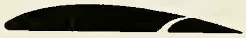
Figure 6. New slotted flap

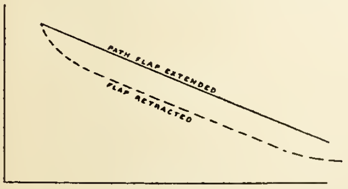

Figure 5

It has long been the wish of designers to extend flaps of all varieties to the very tip of the wing, with lift increase carried to the maximum. Lateral control difficulties have made this difficult so far. Spoilers have appeared effective in the wind tunnel, but, because of lag, have not given satisfactory results in flight; with the spoiler raised into the airstream the wing at first assumes the effect of a higher camber without breakdown of the flow. On the Weick machine a combination of spoiler and slot appears to have solved the difficulty. As shown in figure 4, the straight slot through the wing is always open at its lower end, and partially open at its upper surface. With the spoiler raised, rolling moment is accompanied by "favorable" yawing moment and lag is eliminated. With the ordinary spoiler, right aileron means *at first* left roll, and the pilot naturally overcontrols. With this new aileron, and particularly when the small opening is provided at the top, lag disappears.

Another attempt to secure lift increase action up to the tip of the wing lies in "drooped ailerons." A wind tunnel experiment with conventional ailerons rigged so as to "droop" through some 10° or 15° gave an increase in the maximum lift coefficient of approximately 4%. The rolling moments with such depressed ailerons were only little less than with conventional rigging.

Use of Flaps in Landing

A serious difficulty arises with the use of the split flap in varying the steepness of the glide path, as illustrated in figure 5. Suppose the pilot is gliding in rather steeply with flap extended, and wishes to flatten out the path. The obvious thing is to retract the flap and thus diminish the drag. But this also diminishes the lift coefficient and owing to the low speed the machine drops in space, so that the path actually becomes steeper. It is only after some time that the path becomes less steep than before the flap was retracted. This is a serious drawback in maneuvering during the landing glide.

To meet this difficulty, experiments have been made on a new flap (figure 6) which resembles the Handley Page slotted flap. With this type, at the same angle of incidence of the main wing, the lift coefficient remains constant, although the drag increases as the flap is depressed through a greater angle. Granted that this is the case, it is evident that flap manipulation will change the steepness of the path at will without the drop. In other words with the slotted flap it is possible to maintain the same path speed while changing the steepness of the flight path.

The Weick Monoplane

The Weick monoplane was mounted on the balances in the full scale tunnel. This machine has been rebuilt by the Fairchild Aircraft Corp., under the auspices of the Bureau of Air Commerce. It now incorporates the Handley Page slotted rear flap running substantially the entire span of the wing, and the new type of spoiler-slotted aileron control. The control features received much favorable comment. So did the front wheel landing gear. On the other hand there was a definite opinion that the tractor cabin offered very nearly as much vision as the pusher, particularly when an in-line engine is used, and that the drag of the Weick model would be unduly high. It would seem as if a tractor machine with in-line engine, with the latest control systems, and with the three wheel landing gear would constitute a desirable experiment more likely to be satisfactory in appearance and performance than the pusher.

Interference Effects

The perennial question "How much is a retractable chassis worth?" was illustrated by a series of tunnel tests, with landing gear on and off. With a clean (possibly cantilever) landing gear, calculations indicated that a small high wing machine of about 2000 lbs. in weight, speed might be raised from 115 to 118 m.p.h., giving a 2½% improvement. In the class of 3000 to 4000 lbs. an improvement of 3% might be expected; and in large twin-engine jobs speed might be raised from 200 to 208 m.p.h., or 3%. The small values in drag reduction obtained in these experiments do not agree with the views held by authorities who estimate much higher drag reduction for landing gear retraction.

In another study of interference, an ideal streamline fuselage was tested in combination with a low unsymmetrically cambered wing of rectangular plan form. With exposed radial engine, a high speed of 145 m.p.h. was estimated. With the engine cowled in, speed went up to 180 miles. With filleting of the wing rearwards to the fuselage, the figure rose to 184 miles. With surface cooling and engine drag wholly removed, speed went up to 191. With a symmetrically cambered airfoil there was a further increase to 197 miles. With mid-wing position given to the airfoil, 203 was attained. And finally by tapering the wing, the value rose to 205.

Toeing-out of Twin Engines

Many methods of securing control with one engine out of two in operation have been tried and suggested. An experiment was made during the year in which the engine thrust-lines were "toed-out," so as to meet towards the tail surfaces (figure 7). With this arrangement the slip stream of the engine still firing counteracts the unbalanced turning moment. The discovery was made that the propulsive efficiency was very little affected.

High Speed Airfoil Studies

Langley Field now has a high speed tunnel in which an airfoil of sufficient size can be inserted to permit pressure distribution measurements. The study of pressure distribution throws more light on the "compressibility" burble which occurs at very high air speeds. The distribution of pressure at angle of incidence of 2° and a speed of 550 m.p.h., or .735 of the speed of sound is indicated in figure 8. High speed flow is extremely sensitive to changes in pressure along the path, particularly when the negative pressures reach a value as high as two-thirds of atmospheric pressure, as indicated at the section on the diagram where there is a sudden drop in the suction pressure. As a result there is a region of discontinuity and the entire flow pattern is changed with the formation of "shock" or sound waves. For extremely high speed, airfoils will have to be so designed that there is no marked change in the suction anywhere along their surface.

Propeller Vibration

Methods employed for the analysis of propeller vibrations have been described in NACA Technical Note 516. A propeller is a cantilever beam fixed at its center. As a cantilever beam it may have vibrations of varying frequencies and modes, with the stationary modes at varying points along the blade. By using the theory of dimensional similarity, it is possible to build a propeller of thin cross-section, to run it at a very much smaller speed than the full scale propeller, and to produce vibrations which are related in perfectly definite fashion to the vibrations of the full scale propeller. The thin, model blade while being whirled is enclosed in a tube to avoid air effects. A vibrator is mounted near the hub to impose vibrations at any desired frequency in a vertical direction. Critical frequencies make themselves evident by the propeller tip hitting the metal tube which acts as a bell. If the modes of vibration and the frequencies have been determined in this manner, and if the critical shaft speed of the engine has also been determined, then by plotting curves it is possible to determine at what engine speed a given propeller mode will be in resonance with the critical vibration of the shaft. A coincidence of these factors, or a near-coincidence is evidently dangerous. If the dangerous resonance has been obtained by this method of analysis, then it should be possible to vary the weight distribution of the propeller by removing or adding metal at appropriate points so that the critical condition is removed. The visitors were given an interesting demonstration of this method, and informed that in one case analysis of this character was followed by a displacement of the propeller through 90° on the shaft and complete elimination of the trouble.

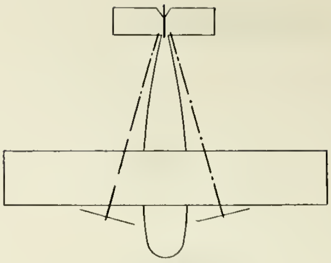
Figure 7

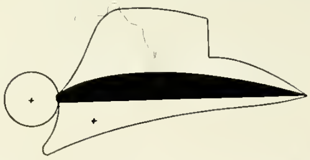
Figure 8. Pressure distribution at high speed

The theory underlying this method was criticised by competent engineers. The method presupposes that only the dynamical effects are important and that once dynamic resonance is removed all dangers of propeller breakage disappears. These engineers were of the opinion that aerodynamic flutter could not conceivably be neglected, and that dynamic vibration and aerodynamic twist and flutter were inextricably combined, rendering the subject much more difficult than these simple physical considerations and methods would indicate.

Autogiro Demonstration

A demonstration of the direct take-off Autogiro served to enliven the proceedings. An Autogiro rotor was mounted with its axis of rotation in vertical guides with a suspension cable loosely attached to its upper end. Underneath the rotor was placed an electric motor with a vertical shaft, and a simple dog clutch between motor and rotor. A 10 ft. diameter rotor, with a 10° pitch, with a normal tip speed of 350 ft./sec. was given an over-speed of some 50% and with the clutch released sailed into the air. The actual amount of the rise depends on the disk loading. Thus with a disk loading of 2 lbs./sq. ft. the rise is only 2.5 ft.; when the disk loading is ¾ lb./sq. ft. the rise is 15 ft. The testing of the vertical rise, brought up a problem in dimensional similarity. With the same tip speed, the same pitch and disk loading, the moment of inertia of the model blades has to be proportional to the fourth power of the radius. Of course even with this law observed, the ground effect is less beneficial on the model than on the full scale rotor.

The Mysteries of Sound

This is an age in which the properties of sound are being studied more effectively than ever before, in aviation no less than in other fields of applied science. The Committee is making a fundamental attack in the analysis of propeller noise. An electrically driven propeller was placed in front of a microphone and connected through an acoustical filter to an amplifier in the full scale tunnel. The filter would be manipulated to "band pass" various frequencies with sharp definition. When all the frequencies developed were allowed to pass through the filter, one heard the sound of the propeller precisely as if a squadron of single seaters were passing through the air. When the higher frequencies were filtered out, the audience had the impression of the airplanes flying out of hearing, as the noise passed gradually into a booming roar. Then as the higher frequencies were again passed through one felt that the airplanes were again approaching. This method of simulating the approach and departure of an airplane is readily explained. The distribution of frequencies and amplitudes or intensities of the propeller is shown in figure 9. The lower frequencies represent the "Rotation Noise," dependent on the r.p.m. and the number of blades. The rotation noise is of the character of real sound waves which pass through the air without dissipation though of course with lowering of intensity. The higher frequencies are due to the shedding of tip vortices (which are present just as in the airfoil) and these vortices are rapidly dissipated as they pass through the air. Hence the "Vortex

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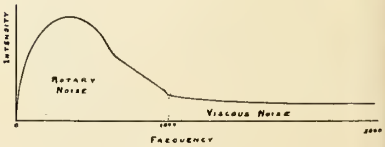

Figure 9

Aviation Training at the Boeing School

●

WILLIAM B. STOUT

● The day when an ambitious designer builds his own plane and goes out to teach himself to fly is over.

It was not so long ago that any man who took a plane off the ground even a few feet and landed again without cracking up too badly could get a license from the F. A. I., but piloting is rapidly becoming a science.

There is just as much difference today between a flyer and a transport pilot as there is between a golf player and a golfer—Bobby Jones, for instance.

In transport work piloting becomes an extremely serious profession and each year it is approached with more care and requirement on the part of the operators and the Department of Commerce.

We used to pick out an air school, advertising that they would teach one to fly for $200; take the course of 10 or 15 hours solo, and thereafter strut around the field with helmet and goggles. Now, such training is only equivalent to learning the alphabet that one will use in writing his later language.

Training pilots is far from just a perfunctory job of teaching. A pilot must not only know how to fly when he can see the ground—which is one technique,—but equally well by instruments when he cannot see beyond his wing tips—which is another technique requiring many more hours of training. It is even a question now if the instrument flying should not be taught first.

Accomplishing these two things, the pilot must also be a radio man with technical and operational knowledge of radio installations and their problems.

He must be at the same time a weather man and meteorologist, able to read the clouds, the wind, and the vacillating vagaries of a weather.

Aside from these he must have some knowledge of metals, structure, stress analysis, and airplane repair requirements, enough to know the condition of his ship in emergencies.

He must understand engines not only in their construction, operation and maintenance, but he must be able to diagnose trouble at the slightest change in sound, and all of this he must be familiar enough with so that it is instinct rather than studied reasons on which he reacts in times of stress.

In the design end much too is new. Wood is passing as an airplane material. Flying wires are being reduced. New materials, duralumin, dowmetal, beryllium, and beryllium and copper alloys are now available. Welding is taking place of riveting in many cases, and the welding of steel structures for the localized stresses of engine mounts may well be a part of his knowledge.

Air-cooled and radial engines have taken the place of water-cooled and inline engines for transport work, while on the horizon are two-cycle Diesels, fuel injection and Propane Gas power plants, all of which the design student must become familiar with if his study is taken in a proper school.

Very few schools in the United States are equipped for the complete study course necessary for the graduation of a modern transport pilot or mechanic.

One hardly realizes the tremendous amount of organization, equipment, and routine preparation that is necessary for modern schooling until he visits some of the State Universities and sees the tremendous amount of detail activity in the background of the comparatively few hours of teaching.

William B. Stout

I had experienced this in ordinary university work before, but as regards aviation had not realized just what was involved in modern practice as compared with the old flying schools until I recently visited the Boeing School of Aeronautics at Oakland, Calif.

This school, which is connected with United Air Lines, has on its flying field and within its 35,000 square feet of school and shop space a more complete organization and curriculum for training pilots and mechanics than I had imagined was in existence.

For example, the two-year (24 months) Airplane Pilot and Operations course comprises 4,015 hours of instruction. This includes 9 months of general aeronautical training and 15 months in elective subjects from field servicing, aircraft engines, aircraft metals, radio operations, instrument servicing and applied design. Along with this ground instruction 250 hours of flying are given in nine types of airplanes, the flying including the latest training in instrument flying, radio operation and landing beam flying. This instruction carries the student much further than necessary to qualify for a Scheduled Air Transport Rating outside of the number of hours required in the air.

The Airline Technician Course for graduates of accredited engineering universities covers 9 months. This course takes post graduate engineering students and gives to them the practical training and experience demanded by chief engineers of major airplane factories.

The fundamental idea of the school in each case is not just to give a man an education in aviation but to actually fit him for certain technical kind of jobs for which men are scarce,—a type of teaching and instruction that our universities would do well to follow.

The school also has added Aeronautical Science to the ground school department for those who are studying to be mechanics, airline operators, etc. This subject is designed to impart the fundamentals of physics as applied in the various aeronautical courses to those students who have not had the required preparatory training in school in this particular field.

While wandering about the hangar where some of the Boeing airliners were being serviced and groomed for their transcontinental work I was able to catch not only some of the spirit of the school and what it is trying to do but could easily see the definite commercial effect in his study that this actual watching of airline operation with passengers day by day would have upon each man studying at the school. These things he is learning are not just school room professional theories, but the latest known methods of solving the problems of the actual business of flying.

The field has as high a rating as any airport in the United States, with an ideal climate for student work almost every day in the year. Buildings are modern and thoroughly equipped, while as you look over the airplanes which the school is using, you get a good idea of the range of experience the students get in their courses:—Boeing 203 and 81 Trainers, Stearman Trainer with J6-5, Boeing

(*Continued on page 76*)

AVIATION ENGINEERING

TECHNICAL EDITORS: GLENN D. ANGLE • DR. ALEXANDER KLEMIN • DR. MAX MUNK • DR. MICHAEL WATTER

The Design of Beam-Columns

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Associate Professor, Oregon State College

● Despite the growing predominance of the monoplane over the biplane, the design problem of a member carrying combinations of axial and lateral loads is a frequent occurrence, and in recent years numerous methods have been devised for its solution. In order to determine the adaptability of the several methods to the various problems which are likely to arise in the analysis of airplane structures, it is proposed in this article to review their comparative merits and limitations.

It is unfortunate that no designation has been adopted, or to the writer's knowledge, has ever been suggested, for a "member subjected to combined axial and lateral loads." For want of a better term, the designation *beam-column* is being employed throughout this article. It has the merit of being comparatively concise, and is virtually self-explanatory. It is limited, however, to members in which the axial load is compressive, and it is to such members that this article is restricted.

Methods Of Solution

In the case of the single span member, the end moments are usually readily determinable—in many cases being zero. The problem is then to determine the bending moment distribution throughout the span. For members which are continuous over three or more supports the problem is more involved, since the theorem of three moments in its usual form (or any equivalent method in common use in other fields of structural design) makes no provision for the effect of the axial load on the bending moments at the intermediate supports. Once the correct values of the moments over the supports are determined, the moment distribution may be determined independently for each span.

Single Span Member

In reviewing briefly the methods by which bending moments between the supports of a single-span beam-column may be found, they may be classified as (a) approximate; (b) analytical; and (c) graphical.

Approximate Methods: The approximate methods are readily applied to pin-ended members of uniform cross-section throughout, carrying a uniform lateral loading. If the ends are restrained, the approximate formulae may still be used with a fair degree of reliability if the distance between the points of inflection is computed. It must be carefully noted, however, that if either of the end moments results from the continuity of the member over a contiguous span, and if such moment has been determined by a method which does not involve the axial loading, both the moment and the location of the points of inflection may be appreciably in error. Probably the best known of the approximate formulae is a slightly modified form of Johnsons'(1).

$$M_{\max} = \frac{M_0}{1 - \dfrac{P(L^1)^2}{10EI}}\text{ , where}$$

$M_{\max}$ = maximum moment in span, including effect of axial load

M_0 = maximum moment with no axial load

P = axial load

L^1 = distance between points of inflection. For pin-ended members L^1 is therefore the span.

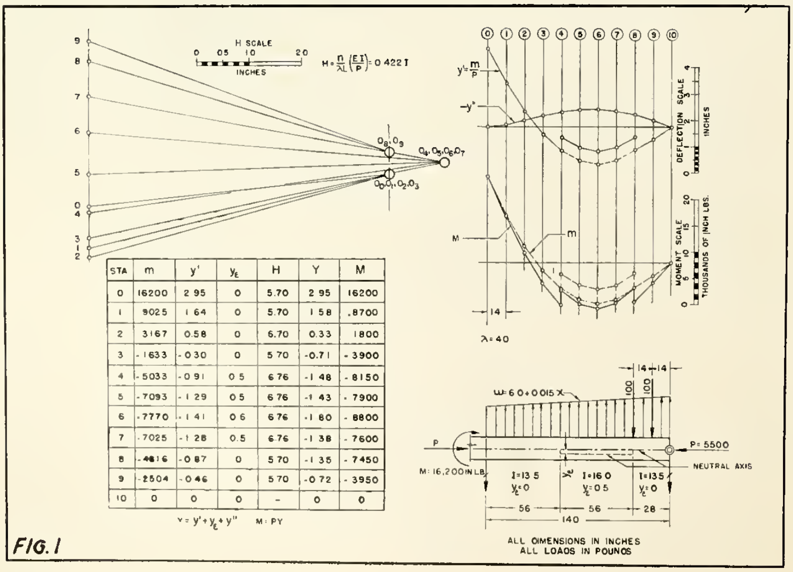
Another well-known approximate formula, essentially similar to the above, is that of Perry(2):

$$M_{\max} = M_0 \frac{P_e}{P_e - P}$$

where P_e is the Euler load for the column of length L^1. Neglecting the effect, usually very slight, of the axial load on the distance between the points of inflection, the distance L^1 may be calculated from the formula(3):

$$L^1 = 2\sqrt{\left[\frac{M_2 - M_1}{wL}\right]^2 - \frac{M_2 + M_1}{w} + \frac{L^2}{4}}$$

where, M_1 and M_2 are the end moments, w, the lateral loading and L, the span. A comparative study of these and several additional approximate methods will be found in reference (3), but the above are as reliable as any, and are the simplest to apply. For any but pin-ended members, these formulae are suitable only for a preliminary estimate, and are of little value when the axial load approaches the Euler load for the member. Their use is furthermore restricted to members of constant moment of inertia carrying a uniform lateral load.



STA	m	y'	y_e	H	Y	M
0	16200	2 95	0	5.70	2 95	16200
1	9025	1 64	0	5.70	1 58	.8700
2	3167	0.58	0	6.70	0.33	1800
3	-1633	-0 30	0	5 70	-0.71	-3900
4	-5033	-0 91	0 5	6 76	-1 48	-8150
5	-7093	-1 29	0 5	6 76	-1 43	-7900
6	-7770	-1 41	0 6	6 76	-1 80	-8800
7	-7025	-1 28	0.5	6.76	-1 38	-7600
8	-4816	-0 87	0	5 70	-1 35	-7450
9	-2504	-0 46	0	5 70	-0 72	-3950
10	0	0	0	-	0	0

$Y = y' + y_e + y''$ $M = PY$

FIG. 1

1: Johnson, Bryan & Turneaure, *Modern Framed Structures*, Vol. II.

2: Pippard & Pritchard, *Aeroplane Structures*.

3: U. S. Army Air Service Information Circular No. 493, Sect. I, *Investigation of Structural Members Under Combined Axial and Transverse Loads*.

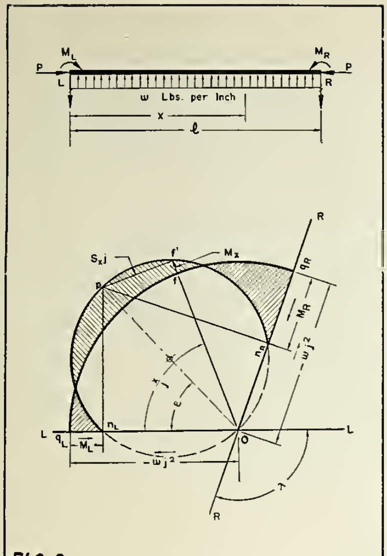


FIG. 2

Analytical Methods: Analytical solutions for the determination of the exact bending moments due to a combination of axial and lateral loads were first presented by Muller-Breslau in Germany and later by Berry in England, the two methods being identical in their essentials. In this country, Niles and Newell simplified these methods somewhat, and extended them to cover a wide variety of cases, their results being first published by the U. S. Army Air corps in 1924(3). This, the so-called *Precise* method, was almost exclusively adopted in this country for the solution of beam-column problems. The Precise formula for the bending moment at any point x in the span has the general form:

$$M_x = C_1 \sin\frac{x}{j} + C_2 \cos\frac{x}{j} + f(w)$$

where $j = \sqrt{\dfrac{EI}{P}}$ and C_1 and C_2 are constants depending upon the end moments M_1 and M_2 and upon the lateral loading, and $f(w)$ depends upon x, j, L and the lateral loading.

The Precise method furnishes relatively simple but exact formulae for the determination of the shear, bending moment, slope and deflection at any point on a beam-column, for almost any variation or combination of lateral loads(4). For simple types of loading, formulae are available for the direct determination of the location of the point of maximum moment, and the value of such moment. For more complex loadings, the direct determination of these two important quantities is either impossible or unduly involved, and plotting of the moments at a number of points must be resorted to.

The Precise method is limited in application to beam-columns of constant moment of inertia throughout the span. The condition of varying moment of inertia cannot be solved except for a few special cases, and these are so involved that they are of no practical value. A constant axial load throughout the span is also assumed, although the effects of small changes in axial load may be satisfactorily approximated. This method furnishes an accurate and fairly rapid solution for many of the problems which are encountered in airplane design. In common with all analytical methods, it is necessary to repeat most of the calculations for each point in the span at which the moment or other function is desired, although by suitable tabulation the work may be greatly simplified.

By a simple transformation, the basic equation of the Precise method may be changed to the polar form, resulting in the equation:

$$m_x = C \cos\left[\frac{x}{j} - \varepsilon\right]$$

where $m_x = M_x - f(w)$ and $j = \sqrt{\dfrac{EI}{P}}$

From this equation, formulae are readily derived for the bending moment and shear at any point, and for the location of the point of, and the value of, the maximum moment, as in the case of the Precise method. Formulae for a few typical cases are given in Table 1, taken from a more complete table in reference (5).

The Polar formulae are in all cases as easily applied as are the Precise formulae. They may be extended to cover, without undue complication, a number of cases which are beyond practical solution by means of the Precise method—as for example, a beam-column with change in moment of inertia between supports. A further distinct advantage of the Polar method will subsequently be pointed out.

Graphical Methods: The relative merits of graphical and analytical solutions are somewhat a matter of personal opinion. A greater degree of accuracy can in general be achieved by the latter process, but with a reasonable amount of care, graphical methods will produce results which are within the usual limits of accuracy desired—provided that the method itself is sufficiently exact theoretically. A graphical method has the advantage that it presents a clear picture of the conditions at *all sections* of the member, while (as already pointed out) an analytical method requires a separate solution for each section investigated. Thus, the point of maximum moment and the points of inflection are immediately located from the bending moment diagram. Graphical solutions are also self-checking, to some extent.

The Gough method developed in England(6,7) has been used generally for the graphical solution of beam-columns in which there are changes in moment of inertia between supports. It also provides for continuous and irregular changes in running load, and may be extended to include the effect of varying eccentricity of the neutral axis with respect to the line of action of the axial load. There are some slight approximations involved, but with reasonable care this method yields results sufficiently accurate for design purposes. Figure 1 shows the solution for a single span lower wing beam, having a continuously varying lateral

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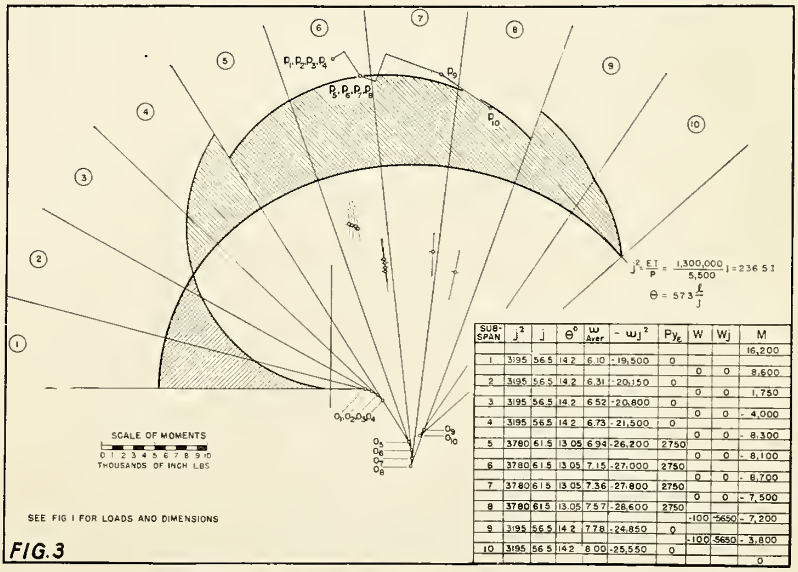
4: U. S. Army Air Corps Information Circular No. 665, *Additional Formulae for Beams Subjected to Axial and Lateral Loads.*

5: W. R. Jones, A.S.M.E. Aeronautics Division Summer Meeting, Berkeley, 1934, *Polar Analysis of Beam-Columns.*

6: Gough, Aeronautical Research Committee R. & M. No. 741. *A Graphical Method for the Determination of the Bending Moments and Deflections in an Aeroplane Spar.*

7: U. S. Army Air Service Information Circular No. 493, Sect. II, *Investigation of Structural Members Under Combined Axial and Transverse Loads.*



SUB-SPAN	j^2	j	θ°	w Aver	$-wj^2$	Py_e	W	Wj	M
									16,200
1	3195	56.5	14.2	6.10	-19,500	0			
							0	0	8,600
2	3195	56.5	14.2	6.31	-20,150	0			
							0	0	1,750
3	3195	56.5	14.2	6.52	-20,800	0			
							0	0	- 4,000
4	3195	56.5	14.2	6.73	-21,500	0			
							0	0	- 8,300
5	3780	61.5	13.05	6.94	-26,200	2750			
							0	0	- 8,100
6	3780	61.5	13.05	7.15	-27,000	2750			
							0	0	- 8,700
7	3780	61.5	13.05	7.36	-27,800	2750			
							0	0	- 7,500
8	3780	61.5	13.05	7.57	-28,600	2750			
							-100	-5650	- 7,200
9	3195	56.5	14.2	7.78	-24,850	0			
							-100	-5650	- 3,800
10	3195	56.5	14.2	8.00	-25,550	0			
									0

FIG. 3

load with superimposed concentrated loads, changes in moment of inertia between supports, and eccentricity of the neutral axis over a portion of the span. Considerable graphical construction is involved, and "trial and error" must be resorted to in order to obtain a satisfactory closure for the y'' or deflection curve —three or more trial solutions usually being required. The illustration shows all necessary calculations beyond those involved in the determination of the primary bending moment m. Trial solutions for the y'' curve are omitted for the sake of clarity.

A graphical solution of the Precise equation has been presented by Watter(8) for the simple case of a uniformly distributed load, and a uniform moment of inertia. It involves the drawing of three base circles or arcs thereof, from which are projected a series of points, permitting the construction of two curves, in rectangular coordinates, which determine the precise bending moment curve. The construction is straight-forward, not particularly time-consuming, and could be extended to cover certain more complex conditions of loading, etc., without becoming unduly involved.

Recent articles have appeared(9,10) presenting graphical solutions of the Polar equations to which reference has already been made. In reference (5), the writer presented a fairly complete treatment of this solution, based upon the original work of Muller-Breslau(11), Howard(12) and others, and included several modifications and simplifications of the graphical construction. Figure 2 shows the solution, by this method, of a beam-column with uniform running load and uniform mo-

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8: Watter, *Aero Digest*, March, 1932, *Graphical Solution of a Beam.*

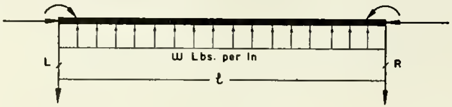
9: Schwarz, *Aero Digest*, July, 1934, *Analyzing Wing Beams by Means of Polar Diagrams.*

10: Naumann, *Aero Digest*, Dec., 1934, *Application of the Polar Diagram to Tapered Beams.*

11: Muller Breslau, *ZFM*, October, 1920, *Zur Berechnung der Tragflachenholm.*

12: Howard, Aeronautical Research Committee R & M, No. 1233, *Graphical and Analytical Determination of Stresses in Beams.*

CASE I



$$m = M - wj^2$$

$$\varepsilon = \text{Tan}^{-1}\frac{m_R - m_L\cos\lambda}{m_L\sin\lambda}$$

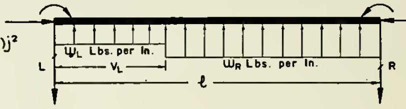
$$C = m_L\sec\varepsilon = m_R\sec(\lambda-\varepsilon) = \operatorname{Cosec}\lambda\sqrt{m_L^2 - m_R^2 - 2m_L m_R\cos\lambda}$$

$$^{*}M_{max} = C + wj^2$$

$$^{*}S_{max} = \frac{C}{j}\sin\varepsilon \quad \text{or} \quad -\frac{C}{j}\sin(\lambda-\varepsilon)$$

CASE II

$H=(w_L-w_R)j^2$



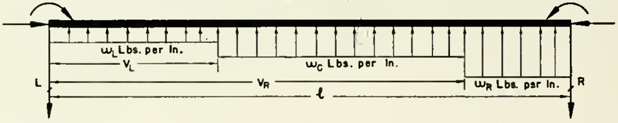
$\theta = \frac{V_L}{j}$

	LEFT SUB-SPAN	RIGHT SUB-SPAN
ε	$\text{Tan}^{-1}\frac{m_R - m_L\cos\lambda - H\cos(\lambda-\theta)}{m_L\sin\lambda}$	$\lambda - \text{Tan}^{-1}\frac{m_L - m_R\cos\lambda + H\cos\theta}{m_R\sin\lambda}$
C	$m_L\sec\varepsilon_L$	$m_R\sec(\lambda-\varepsilon_R)$
$^{*}M_{max}$	$C_L + w_L j^2$	$C_R + w_R j^2$
$^{*}S_{max}$	$\frac{C_L}{j}\sin\varepsilon_L$ or $-\frac{C_L}{j}\sin(\theta-\varepsilon_L)$	$-\frac{C_R}{j}\sin(\theta-\varepsilon_R)$ or $-\frac{C_R}{j}\sin(\lambda-\varepsilon_R)$

CASE III

$\theta_L = \frac{V_L}{j}$

$H_L = (w_L - w_c)j^2$



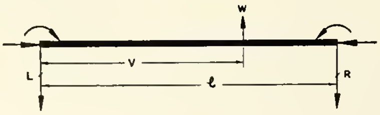
$\theta_R = \frac{V_R}{j}$

$H_R = (w_R - w_c)j^2$

	LEFT SUB-SPAN	CENTER SUB-SPAN	RIGHT SUB-SPAN
ε	$\text{Tan}^{-1}\left[\frac{m_R - m_L\cos\lambda + H_R\cos(\lambda-\theta_R) - H_L\cos(\lambda-\theta_L)}{m_L\sin\lambda}\right]$	$\text{Tan}^{-1}\left[\frac{m_R - \cos\lambda(m_L + H_L\cos\theta_L) + H_R\cos(\lambda-\theta_R)}{\sin\lambda\,(m_L + H_L\cos\theta_L)}\right]$	$\lambda - \text{Tan}^{-1}\left[\frac{m_L - m_R\cos\lambda + H_L\cos\theta_L - H_R\cos\theta_R}{m_R\sin\lambda}\right]$
C	$m_L\sec\varepsilon_L$	$(m_L + H_L\cos\theta_L)\sec\varepsilon_c$	$m_R\sec(\lambda-\varepsilon_R)$
$^{*}M_{max}$	$C_L + w_L j^2$	$C_c + w_c j^2$	$C_R + w_R j^2$
$^{*}S_{max}$	$\frac{C_L}{j}\sin\varepsilon_L$ or $-\frac{C_L}{j}\sin(\theta_L-\varepsilon_L)$	$-\frac{C_c}{j}\sin(\theta_L-\varepsilon_c)$ or $-\frac{C_c}{j}\sin(\theta_R-\varepsilon_c)$	$-\frac{C_R}{j}\sin(\theta_R-\varepsilon_R)$ or $-\frac{C_R}{j}\sin(\lambda-\varepsilon_R)$

CASE IV

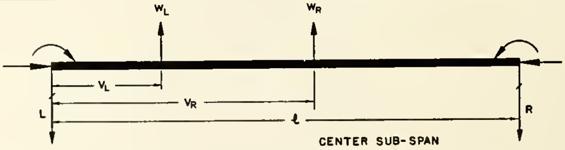
$\theta = \frac{V}{j}$



	LEFT SUB-SPAN	RIGHT SUB-SPAN
ε	$\text{Tan}^{-1}\frac{M_R - M_L\cos\lambda - Wj\sin(\lambda-\theta)}{M_L\sin\lambda}$	$\lambda - \text{Tan}^{-1}\frac{M_L - M_R\cos\lambda - Wj\sin\theta}{M_R\sin\lambda}$
C	$M_L\sec\varepsilon_L$	$M_R\sec(\lambda-\varepsilon_R)$
$^{*}M_{max}$	C_L	C_R
$^{*}S_{max}$	$\frac{C_L}{j}\sin\varepsilon_L$ or $-\frac{C_L}{j}\sin(\theta-\varepsilon_L)$	$-\frac{C_R}{j}\sin(\theta-\varepsilon_R)$ or $-\frac{C_R}{j}\sin(\lambda-\varepsilon_R)$

CASE V

$\theta_L = \frac{V_L}{j}$



$\theta_R = \frac{V_R}{j}$

	LEFT SUB-SPAN	CENTER SUB-SPAN	RIGHT SUB-SPAN
ε	$\text{Tan}^{-1}\left[\frac{M_R - M_L\cos\lambda - W_R j\sin(\lambda-\theta_R) - W_L j\sin(\lambda-\theta_L)}{M_L\sin\lambda}\right]$	$\text{Tan}^{-1}\left[\frac{M_R - \cos\lambda(M_L - W_L j\sin\theta_L) - W_R j\sin(\lambda-\theta_R)}{\sin\lambda(M_L - W_L j\sin\theta_L)}\right]$	$\lambda - \text{Tan}^{-1}\left[\frac{M_L - M_R\cos\lambda - W_L j\sin\theta_L - W_R j\sin\theta_R}{M_R\sin\lambda}\right]$
C	$M_L\sec\varepsilon_L$	$(M_L - W_L j\sin\theta_L)\sec\varepsilon_c$	$M_R\sec(\lambda-\varepsilon_R)$
$^{*}M_{max}$	C_L	C_c	C_R
$^{*}S_{max}$	$\frac{C_L}{j}\sin\varepsilon_L$ or $-\frac{C_L}{j}\sin(\theta_L-\varepsilon_L)$	$-\frac{C_c}{j}\sin(\theta_L-\varepsilon_L)$ or $-\frac{C_c}{j}\sin(\theta_R-\varepsilon_R)$	$-\frac{C_R}{j}\sin(\theta_R-\varepsilon_R)$ or $-\frac{C_R}{j}\sin(\lambda-\varepsilon_R)$

Table 1: Polar formulae for five typical loading conditions

ment of inertia throughout the span. Figure 3 illustrates the solution for the case shown in figure 1. All necessary calculations are included, but some of the construction is omitted to simplify the diagram. It will be observed that the plotting of curves is not required in this method, the diagrams consisting of the polar rays and arcs of circles. There is one exception—in the case of a continuously variable function, the exact solution involves the plotting of a curve. For instance, for a linear variation in running load the resulting curve would be an Archimedean spiral. However, by dividing the span into sufficiently small sectors, the load, etc., may be assumed constant over each sector, and the resultant diagram will consist of a series of circular arcs. Calculation of the primary bending moment is not required for the Polar solution, which, in the case of complex loadings, results in considerable time saving.

It will be noted that this method gives graphical solutions to the Polar equations presented in a previous section of this article devoted to analytical solutions. The analytical solutions may be worked together with the graphical—for those cases where the analytical solution is practical—giving a very desirable check. Thus the Polar diagram can be drawn to give the general distribution of moment and shear throughout the span; the locations and values of the maximum moments and shears may be scaled from the diagrams, and these quantities may be accurately checked by the application of the appropriate analytical equations. This is one of the most attractive features of the Polar method, and the writer has found this procedure to be very convenient in practice.

The Polar diagram may be adapted to almost every conceivable type of loading and section variation, without impairing to any extent the accuracy of the solution. While it may be true that the Gough method, in certain cases of complex load and section variations, will give results comparable in accuracy with those obtained with the Polar method, with little, if any, additional time expenditure, for all other cases the Polar diagram is superior.

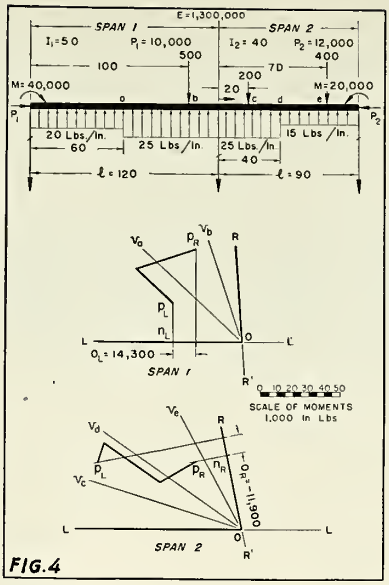


FIG. 4

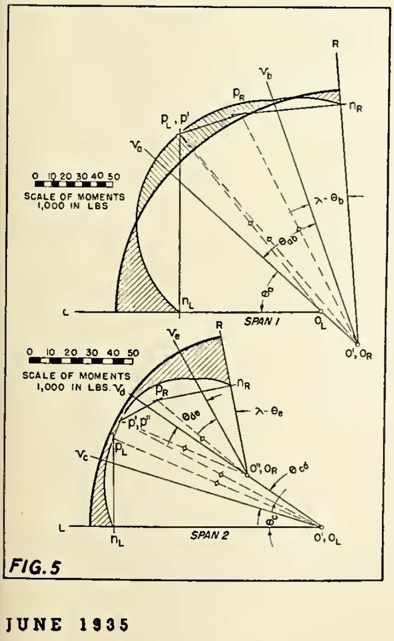


FIG. 5

The Polar method likewise is much simpler and more comprehensive than the graphical method suggested by Watter, and it may therefore be concluded that the Polar method is preferred in all cases where a graphical solution is considered necessary or desirable.

Continuous Beam-Columns

When a beam-column is continuous over three or more supports, the ordinary three-moment equation is no longer applicable. Charts are available(13) which, for certain relationships between length of overhang and lengths of bays, will give approximate solutions for maximum span-moment and the moment over the intermediate support. These devices, however, are limited to the simple case of uniform lateral and axial loading, and a uniform moment of inertia. For such cases the charts are valuable in preliminary design, and even when there is considerable deviation from these conditions, by suitable approximations the charts may be used to obtain preliminary estimates of member sizes.

The Precise method provides an exact three-moment equation for the solution of continuous beam-columns, and by means of tabulated functions the application of the method is considerably simplified. Loading terms, analogous to those of the ordinary three-moment equation, permit a solution for almost any combination of lateral loads. The formula has the following general form:

$$\frac{M_1 L_1 \alpha_1}{I_1} + 2M_{2L}\left[\frac{L_1 \beta_1}{I_1}\right] + 2M_{2R}\left[\frac{L_2 \beta_2}{I_2}\right] + \frac{M_3 L_2 \alpha_2}{I_2} = f(w_1) + f(w_2)$$

$f(w_1)$ and $f(w_2)$ being the loading terms for the two bays, α and β the tabulated functions of L and j, where L is the span length and $j = \sqrt{\frac{EI}{P}}$.

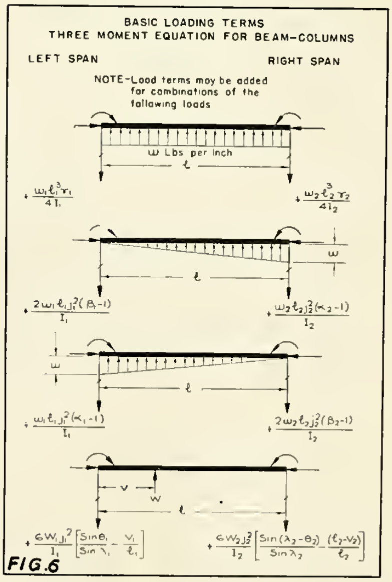
For a uniformly distributed load w:

$$f(w_1) = \frac{w_1 L_1^3 \gamma_1}{4I_1} \text{ and } f(w_2) = \frac{w_2 L_2^3 \gamma_2}{4I_2}$$

γ also being a tabulated function of L and j. Other loading terms, and tables of α, β and γ functions will be found in reference (3, 14).

This method has the disadvantage that it is not applicable except very approximately to members in which there are changes in moment of inertia or axial load between supports, nor can the effects of eccentricities of the neutral axis be included in the solution.

The Polar solution of the exact three-moment equation yields an expression identical with the above. The loading terms are likewise identical except for slight differences in the case of concentrated loads, where angular measure is substituted for length (figure 6). The generalized form of the loading terms of the Polar three-moment equation is, however, such that the effects of changes of moment of inertia between supports may be included. The analytical solution for such terms is somewhat involved, but by a combination of graphical and analytical processes, the procedure is greatly sim-


BASIC LOADING TERMS
THREE MOMENT EQUATION FOR BEAM-COLUMNS
LEFT SPAN
RIGHT SPAN
NOTE-Load terms may be added for combinations of the following loads
w Lbs per inch
ℓ
$+\frac{w_1 \ell_1^3 \gamma_1}{4 I_1}$
$+\frac{w_2 \ell_2^3 \gamma_2}{4 I_2}$
w
ℓ
$+\frac{2 w_1 \ell_1 j_1^2 (\beta_1 - 1)}{I_1}$
$+\frac{w_2 \ell_2 j_2^2 (\alpha_2 - 1)}{I_2}$
w
ℓ
$+\frac{w_1 \ell_1 j_1^2 (\alpha_1 - 1)}{I_1}$
$+\frac{2 w_2 \ell_2 j_2^2 (\beta_2 - 1)}{I_2}$
v
W
ℓ
$+\frac{6 W_1 j_1^2}{I_1}\left[\frac{\sin \theta_1}{\sin \lambda_1} - \frac{v_1}{\ell_1}\right]$
$+\frac{6 W_2 j_2^2}{I_2}\left[\frac{\sin(\lambda_2 - \theta_2)}{\sin \lambda_2} - \frac{(\ell_2 - v_2)}{\ell_2}\right]$
FIG. 6

13: Warner & Short, N.A.C.A. TR No. 251, *Approximations for Column Effect in Airplane Wing Spars.*

14: Niles & Newell, *Airplane Design.*

plified. Graphical construction may also be resorted to in cases involving irregular types of loading, and eccentricity of the neutral axis. When the changes in loading and moment of inertia are continuous, the solution is slightly approximate, the degree of accuracy increasing with the number of sub-spans into which each span is divided—conditions being assumed constant over each sub-span.

Figure 4 shows a continuous beam-column with discontinuous changes in lateral loading and superimposed concentrated loads. Also shown are the apical diagrams for the two spans from which the loading terms may readily be determined. The moment over the intermediate support may then be calculated from the Polar three-moment equation and the final Polar diagrams drawn for the two spans, as in figure 5.

The Gough method is applicable to the more usual cases of continuous beam-columns, and, as in the case of single spans, the effects of continuous variations in running load and moment of inertia may be accounted for. The effects of eccentricity of the neutral axis may also be included. While this method of solution is not particularly complex, it is rather laborious, and involves a trial and error determination for the deflection curve (6, 7).

Summary

It is thus seen that the Polar method is adaptable to practically every type of beam-column problem that is likely to be encountered in airplane design. Its susceptibility to both analytical and graphical treatment is a distinct advantage. While another method may be as satisfactory in some particular case, in no case may any distinct superiority be observed, and the Polar method is therefore recommended for the solution of all beam-column problems, with the possible exception of preliminary estimations where an approximate method might be deemed satisfactory.

Recent Aeronautical Patents

●

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Airplane discharging apparatus. John H. Guffey, Pittsburgh, Pa. (1,993,341)

Aerial signal device. Roland B. Respess, Wickford, R. I., assignor to Respess Aeronautical Engineering Corp., Cranston, R. I. (1,993,414)

Aircraft. Edward A. Stalker, Ann Arbor, Mich. (1,993,419)

Automatic steering systems for dirigible craft. Bradford B. Holmes, Stonington, Conn. (1,993,549, 1,993,550, and 1,993,551)

Aircraft. Harold T. Avery, Oakland, Calif., assignor to Autogiro Co. (1,993,701)

Supercharger. John O. Heinze, Detroit, Mich., assignor to Heinze Development Co. (1,993,963)

Auxiliary airplane propeller. Jose Fernandez, Newark, N. J. (1,994,018)

Airplane. Henry W. Nelson, New York, N. Y. (1,994,045)

Propeller pitch adjusting mechanism. Charles H. Martens, Bryan, Ohio. (1,994,143)

Universal connection. Frederick Barfod, South Bend, Ind., assignor to Bendix Aviation Corp. (1,994,805)

Aircraft. George Van Geons, Jr., Danbury, Conn. (1,995,083)

Seaplane construction, and convertible airplane. Giuseppe M. Bellanca, New Castle, Del. (1,995,089 and 1,995,090)

Rotative wing mounting. Agnew E. Larsen, Huntington Valley, Pa., assignor to Autogiro Co. (1,995,127)

Aircraft carburetor. Emil Schimanck, Budapest, Hungary. (1,995,228)

Radio navigation. Walter Albersheim and Harvey Konheim, New York, N. Y. (1,995,285)

Propeller clamping and balancing ring. John E. Larason, Dayton, Ohio. (1,995,312)

Method of making variable-pitch propeller blades. Alfred A. Handler, Cleveland, Ohio, assignor to Aluminum Co. of America. (1,995,451)

Aircraft rotative wing mounting. Joseph S. Pecker, Philadelphia, Pa., assignor to Autogiro Co. (1,995,460)

Reversing gear for flying machines. Luca Bongiovanni, Turin, Italy, (1,995,467)

Aircraft. Serop Odabashian, San Francisco, Calif. (1,995,717)

Airplane landing light. Edward A. Sipp, Oak Park, Ill., assignor to Pyle-National Co., Chicago, Ill. (1,996.126)

Clutch control mechanism. Harold W. Price and Earl R. Price, South Bend, Ind., assignors to Bendix Aviation Corp. (1,996,256)

Airplane. David J. Dolan, Cleveland, Ohio. (1,996,281)

Emergency landing flare and releasing device therefor. Samuel Wiley Metuchen, N. J. (1,996,694)

Method of making propeller blades. Vincent Bendix, South Bend, Ind., assignor to Bendix Research Corp. (1,996.850)

Gyroscopically-controlled directional indicator for aircraft, and caging and resetting means for gyroscopically-controlled navigation instruments. Joseph S. Bennett, Bradford, Pa. (1,996,895 and 1,996,896)

Holder for parachute pull-cords. Samuel H. Knight, Lancaster, Pa. (1,997,112)

Aircraft. Edwin M. Taniguchi, San Francisco, Calif. (1,997,240)

Regulating the altitude of aircraft. Eduard Fischel, Berlin-Charlottenburg. Germany. (1,997,412)

Airport illumination. Robert P. Parrott, Washington, D. C., assignor to General Electric Co. (1,997,470)

Aircraft having air-rotated wings. Harold F. Pitcairn, Bryn Athyn, Pa., assignor to Autogiro Co. (1,997,600)

Airplane attachment for extinguishing fires. Antonio Arcieri, West Hollywood, Calif. (1,997,669)

Propeller. Edwin E. Arnold, Pittsburgh, Pa., assignor to Westinghouse Electric & Mfg. Co. (1,997,671)

Navigational instrument. Melville C. Wilkinson, Los Angeles, Calif. (1,997,893)

Vertically reciprocating winged naval dirigible airship. Martin Jelalian, New York, N. Y. (1,997,906)

Air terminal device (airplane landing and starting station). Joseph Olaszy, Linden, N. J. (1,997,945)

Flashing aviation beacon. Edward C. Vrooman, Schenectady, N. Y., assignor to Locke Insulator Corp., Baltimore, Md. (1,998,107)

Auto-airplane. Daniel Vieriu, Chicago, Ill. (1,998,148)

Variable-pitch propeller mechanism. John R. Zipay, Pittsburgh, Pa. (1,998,152)

Aircraft tail chassis. Celestino Rosatelli, Turin, Italy. (1,998,204)

Controlling supercharged or other high compression ratio aircraft-engine. Edward Dodson, Streatham, London, England. (1,998,362)

Controllable-pitch propeller. Paul F. Hackethal, Rocky River, Ohio, assignor to Aviation Mfg. Corp., Chicago, Ill. (1,998,407)

Airplane landing guide. Frank J. Andre, College Park, Ga., and Howard C. Stark, Poughkeepsie, N. Y. (1,998,429)

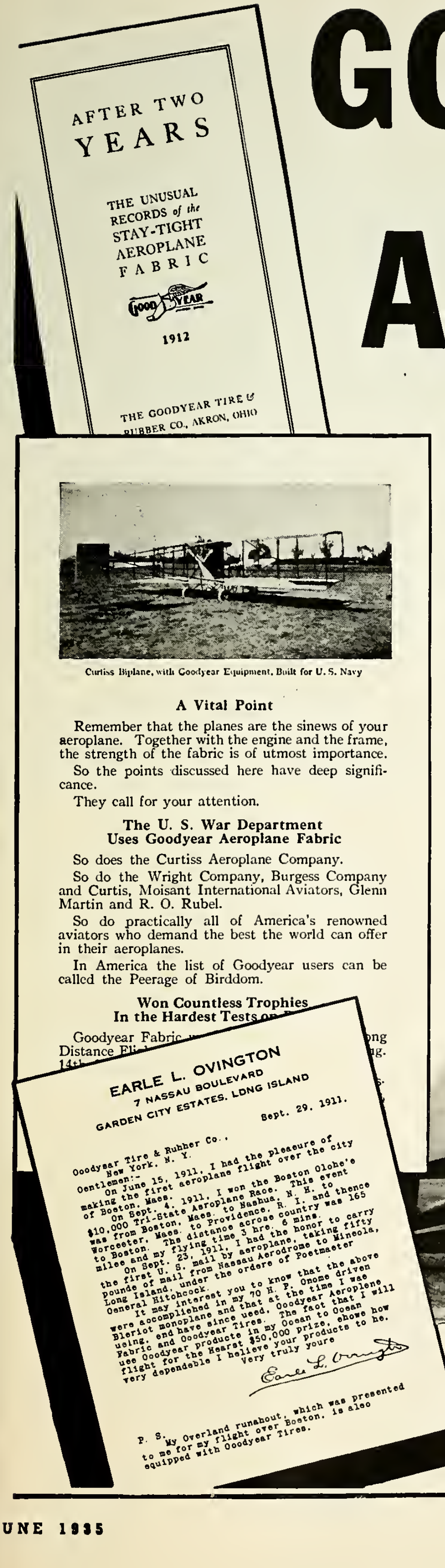
All-wing airplane. Vincent J. Burnelli, New York, N. Y., assignor to Burnelli Aircraft, Ltd. (1,998,487)

Means and method for controlling accumulation of ice upon surfaces exposed to ice-forming conditions. William C. Geer, Ithaca, N. Y. (1,998,809)

Gyrocompass. Bruno A. Wittkuhns, Summit, and Herbert H. Thomson, Mountain Lakes, N. J., assignors to Sperry Gyroscope Co. (1,998,948)

System for landing aircraft. Walter M. Hahnemann, Berlin-Marienfelde, Germany. (1,999,047)

GOODYEAR GREW UP WITH AVIATION



AFTER TWO YEARS

THE UNUSUAL RECORDS *of the* STAY-TIGHT AEROPLANE FABRIC

GOODYEAR

1912

THE GOODYEAR TIRE & RUBBER CO., AKRON, OHIO

Curtiss Biplane, with Goodyear Equipment, Built for U. S. Navy

A Vital Point

Remember that the planes are the sinews of your aeroplane. Together with the engine and the frame, the strength of the fabric is of utmost importance.

So the points discussed here have deep significance.

They call for your attention.

The U. S. War Department Uses Goodyear Aeroplane Fabric

So does the Curtiss Aeroplane Company.

So do the Wright Company, Burgess Company and Curtis, Moisant International Aviators, Glenn Martin and R. O. Rubel.

So do practically all of America's renowned aviators who demand the best the world can offer in their aeroplanes.

In America the list of Goodyear users can be called the Peerage of Birddom.

Won Countless Trophies In the Hardest Tests

Goodyear Fabric

Distance

EARLE L. OVINGTON
7 NASSAU BOULEVARD
GARDEN CITY ESTATES, LONG ISLAND

Sept. 29, 1911.

Goodyear Tire & Rubber Co.,
New York, N. Y.

Gentlemen:-

On June 15, 1911, I had the pleasure of making the first aeroplane flight over the city of Boston, Mass.

On Sept. 4, 1911, I won the Boston Globe's $10,000 Tri-State Aeroplane Race. This event was from Boston, Mass. to Nashua, N. H. to Worcester, Mass. to Providence, R. I. and thence to Boston. The distance across country was 165 miles and my flying time 3 hrs. 6 mins.

On Sept. 23, 1911, I had the honor to carry the first U. S. mail by aeroplane, taking fifty pounds of mail from Nassau Aerodrome to Mineola, Long Island, under the orders of Postmaster General Hitchcock.

It may interest you to know that the above were accomplished in my 70 H. P. Gnome driven Bleriot monoplane and that at the time I was using, and have since used, Goodyear Aeroplane Fabric and Goodyear Tires. The fact that I will use Goodyear products in my Ocean to Ocean flight for the Hearst $50,000 prize, shows how very dependable I believe your products to be.

Very truly yours

Earle L. Ovington

P. S. My Overland runabout, which was presented to me for my flight over Boston, is also equipped with Goodyear Tires.

IT'S a long jump from the kite-like little ships of 1911 to the great coast-to-coast air liners of today.

But over this span of years, you will find Goodyear working hand in hand with airplane manufacturers and flyers —in the interests of safety.

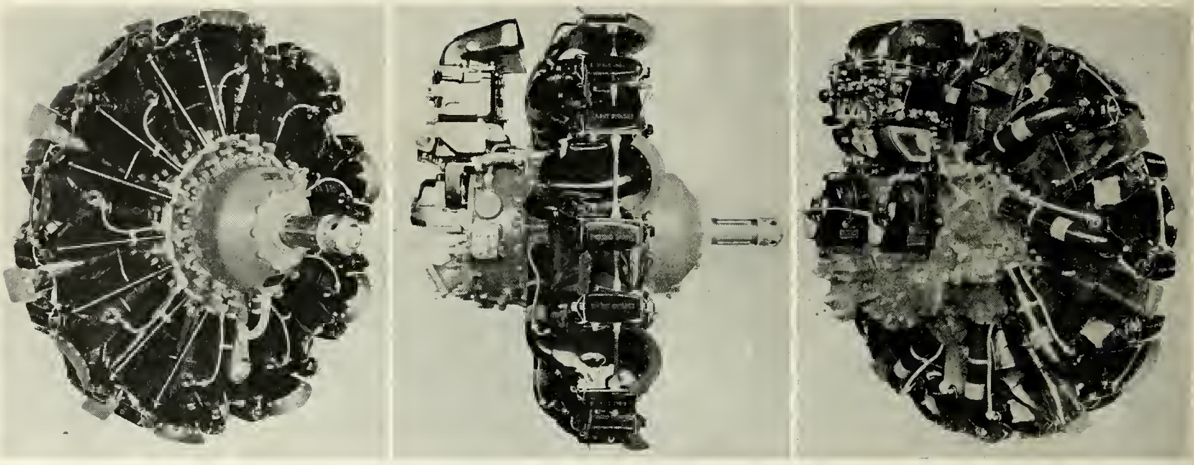
Do you remember the Chicago Meet in 1911? 90% of the entries used Goodyear Tires or Goodyear Aeroplane Fabric.

And today, in increasing numbers, you will find modern transport ships using Airwheels★ for safer, softer landing, and Goodyear's quick-stopping, sure-gripping, sure-releasing Airwheel brakes — hydraulic, pneumatic or mechanical.

If there's any problem you want to solve—if there's anything in rubber you need for airplanes—it's a safe rule to try Goodyear first. Just write Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

★IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL! AIRWHEEL is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of AIRWHEEL Tires

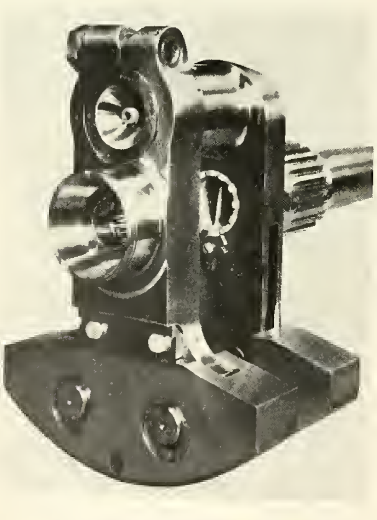
WHEN YOU BUY A NEW SHIP SPECIFY THE GOODYEAR AIRWHEEL AND THE NEW GOODYEAR HYDRAULIC AIRWHEEL BRAKES



Wright Series F-50 Cyclone Engines

● A new group of Wright engines, known as the Series F-50 Cyclones, have just been approved by the Bureau of Air Commerce. Showing higher power ratings than ever before received for single row, air-cooled radial types, these engines incorporate five new features of design in each of the three direct drive models and their geared counterparts.

Approved ratings for the SR-1820F-52 show a one-minute take-off full throttle operation of 820 h.p., a normal sea level output of 740 h.p. and a rating of 775 h.p. at 5800 ft. The SR-1820F-53 is rated 750 h.p. for take off, 685 h.p. at sea level, and 750 h.p. at 11,000 ft., and the SR-1820F-54 is rated 655 h.p. for take-off, 605 h.p. at sea level, and 700 h.p. at 16,200 ft. Geared engines, equipped with a 16:11 propeller shaft reduction gear have similar characteristics as their direct-drive counterparts. All Series F-50 Cyclones are rated on 87 octane fuel performance; they have a bore of 6.125 in., stroke of 6.875 in., and a displacement of 1823 cu. in.



The new Wright dynamic damper

Fundamentally, the F-50 Series follows closely in design and construction the Wright Series F Cyclone, from which it was evolved, and no changes have been made in the basic design. Following the practice of the Series F models, all parts of the Series F-50 Cyclones are interchangeable, with the exception of the supercharger drive gear, which varies in ratio for different operating altitudes with a corresponding change of carburetor settings.

The five major refinements have produced higher power outputs, both at sea level and high altitudes, increased economy of operation and maintenance, and have produced exceptional smoothness of operation.

Briefly these refinements include the dynamic damper, controlled pressure lubrication of the valve gear, a new cylinder head, specially hardened cylinder barrels, and an improved supercharger unit.

The dynamic damper incorporated in the crankshaft assembly of the new series is an exclusive Wright development which promotes smoothness of operation and removes engine speed restrictions throughout the operating range.

In general appearance, the dynamic damper does not differ greatly from the conventional counterweight. It is simple in construction and is adaptable to all Cyclone engines.

It is in principle a pendulum counterweight instead of the conventional rigidly mounted counterweight. The pendulum action is accomplished by mounting a counterweight of the mass necessary to balance the engine in such a manner as to allow it to vibrate through a small angle when disturbed. When the engine is in operation, the restoring force on the pendulum is centrifugal force, which is many times greater than gravity. It can be shown mathematically that the frequency of the pendulum will have a constant ratio to crankshaft r.p.m. In the case of the Wright Cyclone, the frequency of the pendulum is four and one-half times crankshaft r.p.m. since this coincides with explosion frequency. In action the dynamic damper vibrates at explosion frequency but out of phase with the explosion impulses in such a way that it actually introduces a countertorque in the crankshaft which balances out the torque fluctuations which cause the vibration.

Stops are provided to limit the motion of the counterweight during periods of sudden acceleration. These stops are so arranged that they permit a motion considerably in excess of that required to completely damp the vibration at any speed. During normal steady operation, therefore, the counterweight never strikes the stops. Furthermore, the dynamic damper has also been subjected to more than 1000 hours of exhaustive tests, including repeated back-firing and violent aerobatics, without malfunctioning.

The dynamic damper as applied to the Series F-50 Cyclone is not a conventional friction damper, as its action is different and more effective. Since the action of a friction damper is confined to the dissipation (by friction) of some of the energy of the vibration, its actual restraining action on the vibration is limited.

The dynamic damper, on the other hand, is virtually frictionless and dissi-

(*Continued on following page*)

WRIGHT CYCLONES

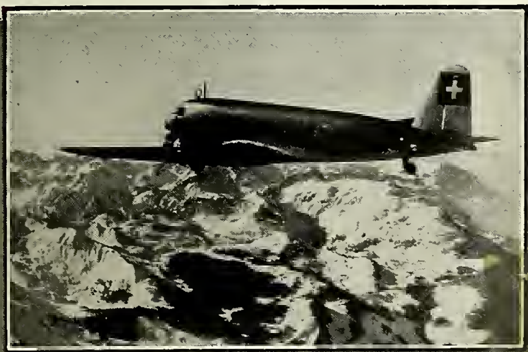
Power famous Airlines of Europe

Last Fall a Wright Cyclone-powered K.L.M. Douglas Airliner sped from London to Australia to win the handicap division of the MacRobertson trophy race and finish second in the speed division against racing craft.

Today, K.L.M. (Royal Dutch Airlines) is operating, over three-quarters of the same route, a fleet of high speed Cyclone-powered Douglas transports. Plying on regular schedule over the 9,000-mile airway from Amsterdam to the Dutch East Indies, these planes have reduced the travel time from 9 to 6 days. Cyclone-powered Douglases and Fokkers are also operated by K.L.M. between Amsterdam and London, Paris, Copenhagen, Hamburg and Berlin, bringing these important centers closer in terms of time than ever before.

Swissair, pioneer of high speed transportation in Europe, operates Wright Whirlwind and Cyclone-powered equipment exclusively between London and Paris, Paris and Lausanne, Berlin and Geneva, Geneva and Vienna, Paris and Zurich and Amsterdam and Zurich. Notwithstanding the difficult flying terrain and variable Alpine weather, Swissair has established an unprecedented record for "on time" operation.

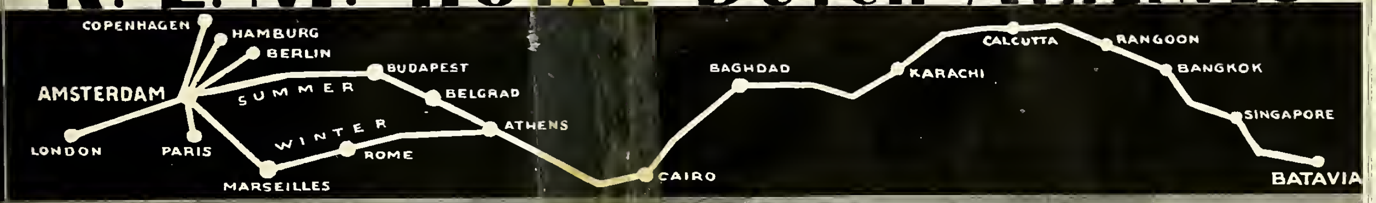
Wright Cyclones also power high-speed transports on the following European airlines: Oesterreischiesche Luftverkehrs A.G. (Austria), L.A.P.E. (Spain), Avio Linée (Italy) and Deutsche Lufthansa (Germany).



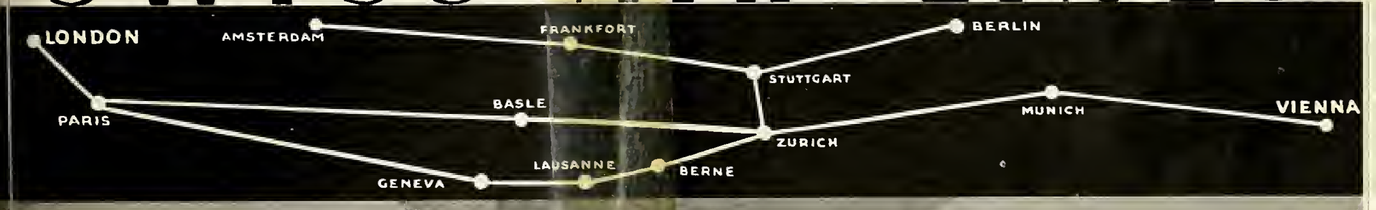
Cyclone-powered Swissair Douglas Airliner

Cyclone-powered K.L.M. Fokker F-36 Transport

K.L.M. ROYAL DUTCH AIRLINES



SWISS AIR LINES



WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

(Continued from preceding page)

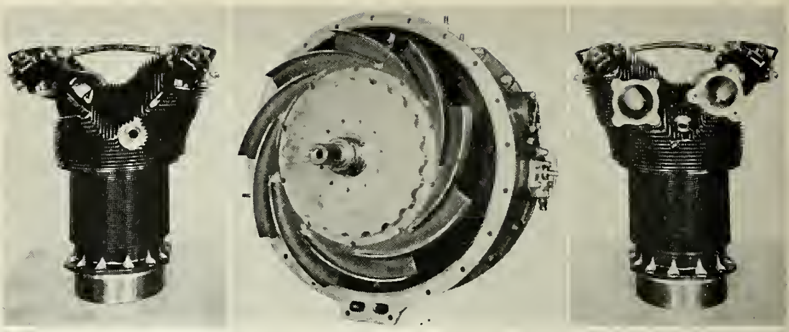
pates essentially no energy by friction. It acts by introducing a balancing force which is opposite to the disturbing force at all speeds. By this action, the dynamic damper has the potential ability to reduce crankshaft torsional vibration to zero.

The controlled valve gear lubricating system brings all parts of the engine under lubrication from the main oil system. Complete control of the oil entering the valve lubricating system is provided by a manually operated valve mounted on the main oil pump. All parts of the valve mechanism can easily be lubricated at periodic intervals by opening this valve for 15 seconds.

The system is simple in design, having no complicated oil passages. Lubricating oil is led from the manually operated control valve through an external oil line to the rocker arm bolts of No. 1 cylinder, and thence into a series of flexible tubes, designed to withstand heat, oil and vibration. These connect all rocker arm bolts of the engine in a continuous and complete circuit. The flexible tubes are attached to fittings at the ends of the rocker bearing bolts which are drilled to provide for the passage of the lubricating oil from one rocker box to the next. Through the metering hole provided in each rocker bearing bolt, a supply of oil is forced into the rocker arm bearing and flows out into the rocker box where it is utilized to lubricate the valve stem, rocker roller and push rod ball ends. A part of this excess oil from the rocker arm bearings passes to the felt pad in the rocker box covers, and is a further aid in the lubrication of the rocker roller, push rod ball ends and sockets.

No lubricating oil from the valve lubricating system is returned to the engine oil supply. When the manually operated control valve on the engine oil pump is opened, only sufficient oil passes into the system to replace that consumed since the last pressure application.

Inasmuch as oil from the engine crankcase cannot enter the valve lubricating system, except during the period while the control valve is open, the possibility of loss of engine oil pressure or the oil supply, in the event of breakage of the flexible tubes is eliminated. Should one or more of the tubes fail, only such oil as remained in the valve lubricating system would be lost. This would in no way impair engine reliability, as sufficient lubrication of the valve gear would be provided from the oil-soaked felt pads in the rocker support box covers. Maximum oil consumption for all engines in this series is 3 gallons per hour at rated r.p.m. (2100).



Views of the cylinder unit and supercharger of the new Wright Cyclone

New cylinder cooling characteristics are responsible for no small measure of the increased performance and dependability of these engines. Built up in accordance with standard Wright practice, aluminum alloy heads are screwed and shrunk onto alloy steel barrels, and fitted with a system of pressure baffles, thus achieving a further reduction in operating temperatures.

Heads have the rocker support boxes cast integrally. Cooling fins are deeper, giving approximately a 20% increase in cooling fin area over the standard F-type cylinder heads, and are so disposed as to improve heat dissipation under any condition. The radio shielded spark plugs employed are cooled directly by the air blast over the cylinder heads. Relocation of the spark plugs, to shorten the flame travel and provide improved heat flow away from the exhaust valve seats, has increased combustion efficiency.

Exhaust and intake ports are located at the rear of the cylinder head. The former, however, being provided with four studs instead of two as in the Series F Cyclone. This permits the use of a stronger exhaust flange and provides for more rigid attachment of the exhaust manifold to the cylinders, increasing the life of the exhaust gaskets and reducing the possibility of leakage. An adapter flange has been designed to allow the use of existing exhaust manifolds.

Cylinder barrels follow the same design as those on the Series F Cyclone. They are machined from alloy steel forgings, and threaded on the upper end for attachment to the head, and are treated to provide an exceptionally hard inner surface. This feature not only appreciably lengthens the life of the cylinder barrels and that of the pistons, but reduces piston ring wear.

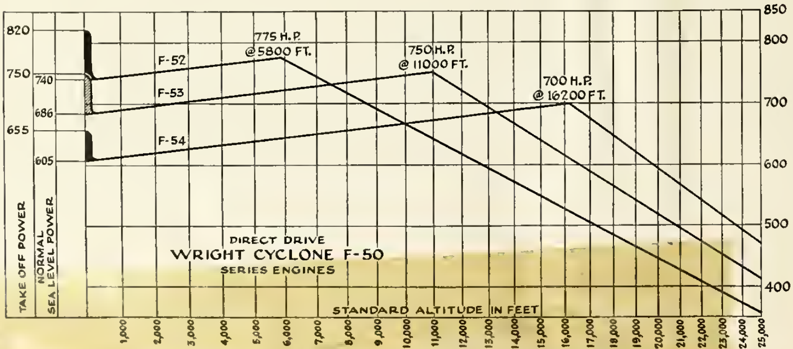
The improved cooling characteristics of the cylinder heads and barrels are augmented by a new system of inter-cylinder and cylinder head baffles developed by the Wright company which insures smooth flow of air over all portions of the heads and barrels, and promotes uniformity of cooling. The inter-cylinder baffles direct the cooling air to the rear of the cylinder barrels while the cylinder head baffles force the airflow to follow the contour of the cylinder heads to the rear spark plug.

Lugs on the rocker support boxes provide for the attachment of ring or other types of low or anti-drag cowling.

Basically, the same supercharger unit as that employed in the Series F Cyclone is used in the new engine, having an 11" supercharger impeller, rotating at relatively low speeds and operating on plain bearings. The principal improvement introduced is the reduction of clearances to prevent air leaks and the redesign of the curvature of the diffuser vanes to provide more efficient passages. The effect of these improvements has been to maintain the performance of the Cyclone at sea level with lower manifold pressures than heretofore have been possible, while also obtaining better performance at operating altitudes.

Modifications have been made in the rear section to provide greater ease of

(Continued on page 36)



Graph showing power at sea level and at various altitudes

GOODRICH TIRES STANDARD

SAFETY EQUIPMENT

FOR ALL TAYLOR "CUBS"

TAYLOR "CUB" IN FLIGHT
Equipped with Goodrich
Low Pressure Silvertowns

ANOTHER O.K. FOR GOODRICH

Read what Mr. C. G. Taylor, President, Taylor Aircraft Company says:

"Goodrich Tires and other Goodrich rubber products for airplanes have been used by this company for over eight years. Both the products, and The B. F. Goodrich Company have given excellent service."

Extra Safety of Goodrich Silvertowns Proved by Taylor Aircraft Company's 8-Year Use!

For quick business hops or just plain "joy riding," the new Taylor "Cubs" have what it takes. Speed. Comfort. Low cost operation. Plenty of advanced safety features — including Goodrich Airplane Silvertowns.

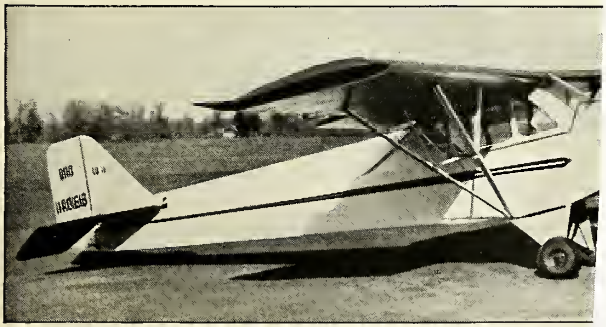
For smooth, safe landings

Bumps—ruts—sharp stones—Silvertowns take
them all in their stride.
and jar. You can see
the tread of this hu
"footprint" it makes.
vertowns so sure-foot
or soft, gummy grou
fect does it! And wit

less rebound—Silvertowns actually save your planes many destructive strains. Passengers appreciate the comfort of these gentler landings.

Protect your ships

Whether you sell planes or sell travel by air, the extra safety and comfort of Goodrich Airplane Silvertowns are worth mu
plane mak



TAYLOR "CUBS" LINED UP FOR FLIGHT. A compact, easy-to-han
plane. Costs no more than the average medium-priced autom
sumption 3 gals. per hour at 70-mile cruising speed. All "Cub
with Goodrich Airplane Silvertowns for safe, cushioned landin

Goodrich *Airpl*

THE SAFEST AIRPLA

Over 40 Rubber Products for Airplanes—including Tires
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Waco Model D Series Convertible Military Types

● Since the Waco Aircraft Co. first entered the export field in 1927, their product has been introduced in 27 foreign countries and U. S. possessions.

Earlier armed models were conversions of existing commercial design. Their success, however, encouraged the design of a strictly military airplane which not only embodied the requirements of modern service tactics, but retained Waco performance characteristics.

Development, begun early in 1933, continued steadily until early this year when the military Model D was marketed. This model is available in six different types, the CHD, JHDA, WHDA, SHDA, S3HDA, and the S2HDA. All are basically identical, but differ in purpose, armament and power plant. With the exception of the CHD their engine installations and weights are listed in the accompanying table. The CHD, which is intended only for primary training purposes and carries no armament, weighs, empty 2200 lbs. (998 kgs.) and fully loaded, 3200 lbs. (1453 kgs.).

Construction

Wing structure consists of two spruce spars, spruce and mahogany plywood ribs, dural-tube compression members, dural-sheet leading edge extending to the top and bottom of the front spar, and a cadmium-plated steel trailing edge. The entire wing is fabric-covered. Metal-covered ailerons are on all four wings, hinged at an angle to the plane's transverse axis. Upper wing is in two sections, joined at the centerline of, and slightly above, the fuselage at about the eye-level of the pilot. Lack of a center section allows uninterrupted vision above and below the upper wing owing to the tapering of the wings toward the center. Wings at this point are supported by single vertical struts. Interplane bracing is by splayed-out *N* struts, and external bracing is by streamline wires.

Welded chrome molybdenum steel tubing with rigid bracing is used in the fabric-covered fuselage construction. The structure is faired to an elliptical cross-section merging gradually to a circular section at the engine cowl.

Pilot and gunner are seated close together in a transparent sliding cockpit enclosure, which affords easy egress by parachute, and makes possible easy conversation. For normal use of the flexible gun, the gunner is enclosed. Dual controls are adjustable, and an adjustable seat is provided for the pilot. The observer's seat is of the sliding type. Windows are in the lower sides of the fuselage ahead of the front cockpit, and these together with the wing stagger, the absence of center struts, the wing root cut-outs and the position of the seats relative to the upper wing, provide unusual visibility. All controls are mounted on ball bearings.

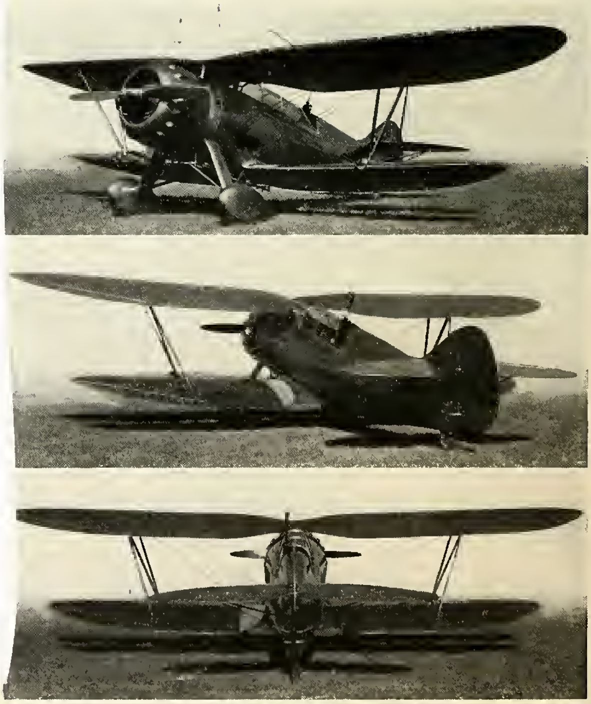
Combination wood and metal construction is used in the tail unit. Stabilizer and fin have wood spars with aluminum alloy ribs; rudder and elevators steel tubular spars with aluminum alloy ribs. All surfaces are fabric-covered. Trimming in horizontal flight is accomplished by conventional adjustment of the stabilizer in flight, and direction trimming, on the ground, by a metal tab on the rudder trailing edge.

Undercarriage wheels maintain a constant angle during shock absorber travel. There is no axle, as such, and all attachments to the fuselage are rigid. Medium pressure wheels equipped with wheel pants are used, and brakes are toe-operated by either occupant. The plane is stressed for and equipped with necessary attachment fittings for Edo floats.

The Model D is designed for a wide variety of equipment as necessary, for photographic work, mail service, or as an ambulance.

Equipment

Each model of the D series is equipped with the following: direct electric starter and generator, Hamilton Standard pro-



Outlines and views of the Waco Model D Series equipped with machine guns and bomb racks peller, landing lights, three electrically discharged parachute flares, complete engine shielding and airplane bonding, wheel fairings, wing root fairings, sliding cockpit enclosures, electrical ammunition counter for fixed wing guns where furnished or provided for, 90-gallon fuel capacity, navigation lights, adjustable parachute seat for pilot, brakes, dual controls, adjustable rudder pedals, tail wheel, tool kit, first-aid kit and fire extinguisher.

Instruments in the pilot's cockpit are an airspeed indicator, altimeter, tachometer, compass, oil pressure gauge, oil temperature gauge, fuel pressure gauge, fuel quantity gauges, bank and turn indicator, rate of climb indicator, thermocouple, voltmeter, and clock. Navigating instruments are mounted on an indirectly lighted panel and may clearly be seen by the observer in ordinary operations.

Instruments in the observer's cockpit are an airspeed indicator, altimeter, tachometer, compass, oil pressure gauge, oil temperature gauge, fuel pressure gauge.

Armament

As a two-place pursuit, the airplane is provided with a fixed Browning aircraft machine gun of either .30 inch or 7 mm. caliber mounted in each lower wing. These guns are remote-controlled by the pilot who is provided with a U. S. Air Corps gun sight. Provision is made in this installation for 1000 rounds of ammunition.

There is also a flexible gun of the same type as the fixed gun. This is mounted on an arm which swings from side to side of the rear cockpit and permits firing vertically down over each side of the fuselage in addition to covering the rear in the conventional manner. Provision is made for 500 rounds of ammunition.

Two type A-3 bomb racks may be provided. They are mounted in tandem under the fuselage and accommodate

Power plant and weight specifications of the Waco Model D Series

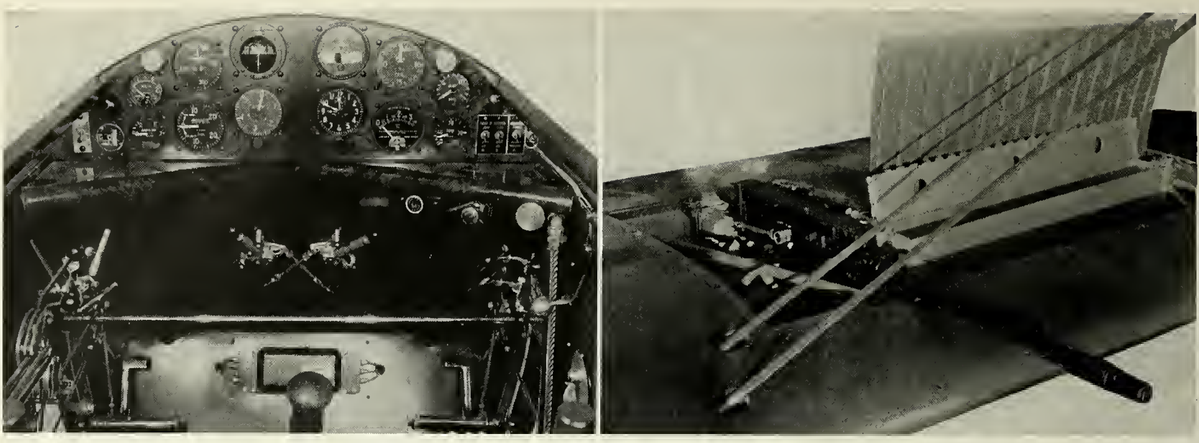
MODEL DESIGNATION	JHD	WHD	SHD	S3HD	S2HD
POWER PLANT	WRIGHT R-975-E 330 H P AT 2000 RPM	WRIGHT R-975-E-2 420 H P AT 2150 RPM	PRATT WHITNEY WASP JR T-1-B 320 H P at 2000 RPM	PRATT WHITNEY WASP JR TB 400 H P at 2200 RPM	(NOTE II) PRATT WHITNEY WASP JR SB 400 H P at 2200 RPM at 5000 ft
Basic Trainer - adapted for addition of one bomb rack, one fixed wing gun and one flexible gun, observers. Less guns, mounts, bomb rack, and ammunition boxes 90 gallon fuel capacity	E 2399 lbs 1089 kgs G 3400 lbs 1544 kgs		E 2435 lbs 1105 kgs G 3427 lbs 1556 kgs		
2-Place pursuit - one bomb rack, one fixed wing gun, one flexible gun 90 gallon fuel capacity	E 2507 lbs 1138 kgs G 3689 lbs 1675 kgs	E 2537 lbs 1152 kgs G 3719 lbs 1688 kgs	E 2543 lbs 1155 kgs G 3725 lbs 1691 kgs	E 2543 lbs 1155 kgs G 3725 lbs 1691 kgs	E 2543 lbs 1155 kgs G 3725 lbs 1691 kgs
2-Place pursuit - one bomb rack, two fixed wing guns, one flexible gun 90 gallon fuel capacity	E 2551 lbs 1158 kgs G 3765 lbs 1709 kgs	E 2581 lbs 1172 kgs G 3795 lbs 1723 kgs	E 2587 lbs 1175 kgs G 3801 lbs 1726 kgs	E 2587 lbs 1175 kgs G 3801 lbs 1726 kgs	E 2587 lbs 1175 kgs G 3801 lbs 1726 kgs
2-Place Observation - two bomb racks, one flexible gun, one wing gun, two-way RCA radio, Fairchild F-8 camera 65 gallon fuel capacity (NOTE I)	E 2612 lbs 1189 kgs G 3768 lbs 1711 kgs	E 2642 lbs 1199 kgs G 3798 lbs 1724 kgs	E 2648 lbs 1202 kgs G 3804 lbs 1727 kgs	E 2648 lbs 1202 kgs G 3804 lbs 1727 kgs	E 2648 lbs 1202 kgs G 3804 lbs 1727 kgs
2-Place Photographic - Fairchild F-8 camera, one wing gun 110 gallon fuel capacity	E 2483 lbs 1127 kgs G 3732 lbs 1684 kgs	E 2513 lbs 1141 kgs G 3762 lbs 1708 kgs	E 2519 lbs 1144 kgs G 3768 lbs 1711 kgs	E 2519 lbs 1144 kgs G 3768 lbs 1711 kgs	E 2519 lbs 1144 kgs G 3768 lbs 1711 kgs
2-Place ground attack - two bomb racks, one flexible gun, one wing gun, one down gun observer's cockpit 65 gallon fuel capacity (NOTE I)	E 2573 lbs 1168 kgs G 3761 lbs 1707 kgs	E 2603 lbs 1182 kgs G 3791 lbs 1721 kgs	E 2609 lbs 1184 kgs G 3797 lbs 1724 kgs	E 2609 lbs 1184 kgs G 3797 lbs 1724 kgs	E 2609 lbs 1184 kgs G 3797 lbs 1724 kgs
Single Place bomber - two bomb racks, two fixed wing guns 110 gallon fuel capacity	E 2539 lbs 1153 kgs G 3773 lbs 1713 kgs	E 2569 lbs 1166 kgs G 3803 lbs 1727 kgs	E 2575 lbs 1169 kgs G 3809 lbs 1729 kgs	E 2575 lbs 1169 kgs G 3809 lbs 1729 kgs	E 2575 lbs 1169 kgs G 3809 lbs 1729 kgs
Single Place mail plane - RCA two-way radio 110 gallon fuel capacity	E 2437 lbs 1106 kgs G 3800 lbs 1725 kgs Mail 443 lbs load 201 kgs	E 2467 lbs 1120 kgs G 3800 lbs 1725 kgs Mail 473 lbs load 215 kgs	E 2473 lbs 1123 kgs G 3800 lbs 1725 kgs Mail 479 lbs load 217 kgs	E 2473 lbs 1123 kgs G 3800 lbs 1725 kgs Mail 479 lbs load 217 kgs	E 2473 lbs 1123 kgs G 3800 lbs 1725 kgs Mail 479 lbs load 217 kgs
Single Place ambulance - litters for two patients 110 gallon fuel capacity	E 2429 lbs 1103 kgs G 3789 lbs 1720 kgs	E 2459 lbs 1116 kgs G 3819 lbs 1734 kgs	E 2465 lbs 1119 kgs G 3825 lbs 1737 kgs	E 2465 lbs 1119 kgs G 3825 lbs 1737 kgs	E 2465 lbs 1119 kgs G 3825 lbs 1737 kgs

Note I—*65 gallons of fuel represents the amount that may be carried with all other equipment as listed, and with two occupants at design gross load. However, 90-gallon fuel tanks are provided in this model and this amount may be carried with partial load to compensate or may be carried as load in excess of design capacity in an emergency.* Note II—*Develops 375 h.p. at 2300 rpm at 7500 ft. (2286 meters).*

PERFORMANCE FIGURES

Model	Horizontal Maximum Speed at Rated RPM at										Service Ceiling		Climb per Minute at								Speed at Sea Level at 105% of Rated RPM	
	Sea Level		1000 Meters 3281 Feet		2000 Meters 6562 Feet		5000 Meters 16404 Feet		Service Ceiling				Sea Level		1000 Meters 3281 Feet		2000 Meters 6562 Feet		5000 Meters 16404 Feet			
	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH	METERS	FEET	M	FT	M	FT	M	FT	M	FT	KPH	MPH
CHD	250	156	245	152	238	148	-	-	211	130	4350	14270	288	947	216	710	153	507	-	-	254	158
JHD	277	172	271	168	263	163	226	140	221	137	5230	17160	391	1288	324	1030	242	794	46	152	281	175
WHD	283	176	278	173	271	168	237	147	229	142	5500	18050	458	1503	371	1216	288	947	65	213	289	180
SHD	283	176	278	173	271	168	237	147	229	142	5500	18050	458	1503	371	1216	288	947	65	213	289	180
S3HD	283	176	278	173	271	168	237	147	229	142	5500	18050	458	1503	371	1216	288	947	65	213	289	180
S2HD	258*	160	-	-	290	180	269	167	236	146	6892	22814	299*	980	-	-	374	1226	152	501	-	-

* With throttle stop: 325 H.P. at 2000 RPM



Details of the pilot's cockpit and a wing gun installation on the Waco Model D

five 25-pound bombs each, or two 125-pound demolition bombs in the front rack. The release controls are installed in either the pilot's or observer's cockpit.

By reducing slightly the fuel or ammunition load, three machine guns, (two fixed and one flexible) and two bomb racks or a part of this armament plus two-way radio and Fairchild F-8 camera equipment can be carried.

The gun turret-type fairing may be removed quickly with a quarter turn on the self-locking Dzus screws that hold it in place. When the airplane is flown without armament the entire fairing assembly may be replaced with a flat plate attached similarly and offering no drag.

When firing to the rear and parallel to or above the line of flight, the observer may remain enclosed and seated, and is only partially exposed to the wind if firing straight down. His seat may be moved to permit him to ride facing either way. When riding facing forward, a strap-type back rest is provided.

An additional 20 gallons of fuel may be installed in any type where the gross weights shown in the accompanying illustration do not exceed 3650 lbs. without reduction in armament, ammunition, or bomb load. It may, of course, be provided in any type and other loads reduced when full tanks are carried.

WRIGHT CYCLONE ENGINES

(*Continued from page* 32)

installation. Larger attaching studs have been provided for the oil pump, and the oil inlet and outlet connections have been dropped to a position slightly below their former location to improve accessibility and prevent interference with other accessories.

An angle drive for the attachment of an instrument vacuum pump or robot pilot pump has been provided at the right side of the rear section at the point where the tachometer drive was originally located. The tachometer drive has been moved beside the fuel pump and provided with a new type of oil seal. The design and location of the tachometer drive provide adequate clearance for the use of electric tachometer generators. All accessory drives have been strengthened by the use of involute splines.

ENGINEERING CONFERENCE

(*Continued from page* 22)

Noise" is not heard so far away. With this kept in mind the simulation of approach and departure explains itself.

Towing Basin Experiments

Experimentation in the towing basin was of the simple, practical character. One experiment consisted in the towing of a flap surface at 1½° incidence, so that the resistance was substantially that of a flat plate moving edgewise to the water. A smooth, aluminum surface, and then surfaces with rows of rivets placed transversed and longitudinally in a disposition similar to that of an actual hull, were towed through the water. Dimpled mushroom rivets gave an increase of 12% over the smooth surface; brazier heads gave an increase of 5%; round headed projecting rivets raised the figure to 17%. Smooth under surfaces for the hull or float, or completely countersunk rivets are therefore well worth while.

Engine Research

An enormous amount of detailed test work has been carried on in the engine research laboratories, and space limitations will permit us merely to enumerate briefly the problems to which attention has been given.

The performance of the experimental fuel injection has been considerably improved. With boost the M.E.P. has been increased to 210 lbs./sq. in. In one test of a fuel injection engine consumption was reduced to .38 lbs./h.p./hr. The power of the fuel injection engine has been raised to equal that of a carburetor engine working under similar conditions.

With the use of a pitot tube, construction with hypodermic tubing 3/1000th of an in. in diameter, exploration of air velocity between fins, has been carried out, and problems in fin spacing are being attached.

With suitable baffles it is possible to keep the air stream in contact all round the cylinder with none of the detachment of the flow found in unbaffled engines.

Considerable progress has been made in the two cycle engine with piston controlled inlet, and four exhaust poppet valves, and two rotary valves to terminate the scavenging cycle.

Work has been done on pre-combustion chambers and displacement chambers in connection with fuel injection design.

Photographic methods for studying combustion have been improved.

A whole program of tests has been carried out on pressure drop and air volume with different cowling openings front and rear, at varying outputs.

A new type of static bomb has been developed with which it is possible to study the distribution of the spray with various types of injection orifices.

The effect of compression ratios on engine friction has been studied and curves of friction h.p. plotted against compression ratio at varying r.p.m.

Heat transfer coefficients have been related to the weight velocity of the cooling air, and experiments have been conducted with a single cylinder engine firing and checked by the introduction of heat by electrical means.

The engine work was mostly of a detailed character, with vast data accumulated which will appear in reports in due course.

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Pratt & Whitney Automatic Power and Mixture Control

GUY E. BEARDSLEY, Jr.

Project Engineer, Pratt & Whitney Aircraft Company

The author has been actively associated with the development of the automatic power and mixture control for the past two and a half years, and the following article was based on a paper presented at a recent regional meeting of the Society of Automotive Engineers at Hartford, Connecticut.

● From general reports available on fuel consumption it is apparent that some method of mixture control is desirable. It is also highly desirable from a standpoint of engine reliability and durability that a means of controlling the horsepower output of supercharged engines, as well as the fuel consumption, be provided. The device herein described provides both these features with certain limitations, and is now available for use in connection with the latest models of Pratt & Whitney engines.

Because of the high performance demanded from modern aircraft engines, a point in their development has been reached where excessive leaning out by the mixture control becomes dangerous. This means that the pilot must be instructed in how to properly set the mixture control in accordance with a method based on the speed variations of an engine turning a fixed-pitch propeller. This is perhaps the best known and most widely used method of adjustment.

With the advent of the constant speed propeller, however, it is obvious that it must be abandoned unless provision is made to lock the propeller at one pitch setting to permit mixture adjustment.

Furthermore, full throttle operation of supercharged engines is not permitted below a specified altitude, and it is important that some method of limiting this power be employed. Supercharger pressure gauges are used extensively but require the pilot's constant attention if maximum allowable power is to be obtained at all altitudes.

Regulated fuel consumption therefore becomes more important and while throttle stops limit power below the critical altitude where full throttle operation is permissible, automatic supercharger regulators (or boost controls) give ideal regulation of engine power output.

With any of the above arrangements a means is provided to override the power limitation, and sufficient fuel feed from the carburetor must be provided so as to avoid damage to the engine if the pilot exceeds the limitation.

The normal action of a carburetor is shown graphically in figure 1. As the throttle is opened and more power is available from the engine, the mixture delivered by the carburetor should be rich enough to insure smooth reliable operation. This necessitates the shape of specific consumption curve shown by the solid line. From the lowest r.p.m.'s where the main metering system is in operation up to the low point on the curve, the carburetor is delivering virtually a constant fuel-air ratio, the downward slope to the curve being caused by increasing mechanical efficiency of the engine. Above the lowest point (2180 r.p.m.) it is desirable for reliable engine operation to gradually increase the specific consumption. This is usually accomplished by a mechanically operated needle valve bringing an auxiliary jet into operation. For sea level rated engines the curve would stop at the line marked *maximum allowable sea level power,* but in the case of an altitude rated engine it would continue on up as shown.

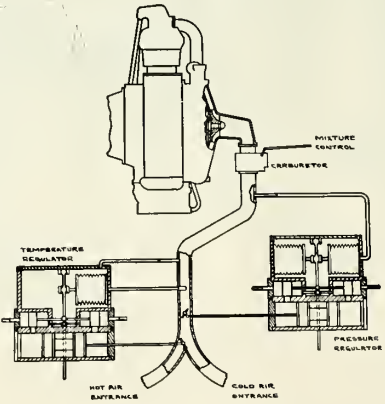

Fig. 2. Diagrammatic sketch of the method by which temperature and pressure regulators can be used to maintain constant air density

Due to the inherent metering characteristics of a venturi-type carburetor, the fuel-air ratio increases with decreases in density of the air entering the venturi. For this reason the curve moves upward as the airplane ascends. To properly correct for this, a device sensitive to changes in fuel-air ratio should be used and such a device would also have to compensate for changes in air flow, as it is not necessary to have the enrichment shown from 2180 to full throttle above an altitude where the full throttle power does not exceed the value obtained at 2180 at sea level. Present available devices for measuring fuel-air ratio (such as they are) are too cumbersome to be usable.

As any automatic device must have a definite medium to act upon, the air density seems to be the most auspicious. By automatically controlling needle valves in the carburetor in response to changes in air density entering the venturis, a solution would theoretically be possible. However, fuel metering by positioning needle valves is not extremely accurate in view of the tremendous change in orifice coefficient with small changes in needle position. In this respect it is pointed out that even though the needle

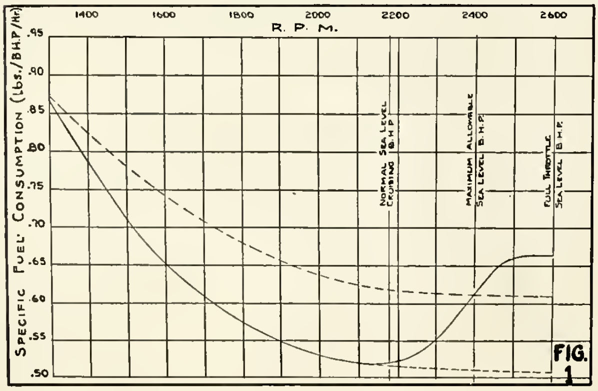

FIG. 1

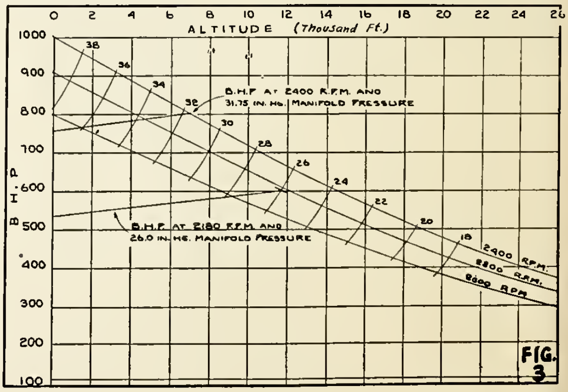

FIG. 3

may be held at a definite height in the orifice a change in orifice coefficient occurs if the needle is moved from a concentric to an eccentric position.

Relatively low velocity air, as used in conventional back suction mixture controls, is easier to regulate accurately with a needle valve than gasoline flow, but the application of a single automatically controlled back suction valve merely produces a fuel curve as shown in figure 1 at all autitudes, and at full throttle at high altitudes gives a richer mixture than the power output warrants. This condition is exaggerated in an engine having a high altitude rating where provision has been made in the basic fuel curve for possible over-riding of any of the above mentioned methods of power limitation.

It was pointed out that changes in air density entering the venturis cause the changes in carburetor metering with changes in altitude. If, therefore, there was maintained a constant density entering the carburetor venturis, we should have a carburetor delivering a mixture corresponding to the solid line curve in figure 1.

The late Mr. Thorp Hiscock evolved the basic idea of accomplishing both a power limitation and a control of the mixture with one unit by throttling the air entering the carburetor to maintain the density of the air entering the venturis equivalent to that at any altitude. Figure 2 shows diagrammatically the method by which temperature and pressure regulators can be employed to maintain a constant air density and the effects of such regulation on engine power output will now be considered.

Figure 3 is a typical power curve showing the normal variation with altitude. The curves sloping downward from left to right are full-throttle constant-speed points. Assuming this engine to have a rating of 800 h.p. at 2400 r.p.m., the critical altitude for this rating is 7,000 ft. Below this altitude, full throttle operation is not permitted. If therefore the absolute pressure entering the carburetor is regulated so that it never exceeds the equivalent of this altitude, power can never exceed the maximum allowable value. Due to the effect of exhaust back pressure the power output of the engine will decrease slightly at altitudes below the critical point. The constant speed and manifold pressure line drawn from the critical altitude points slightly downward, and to the left to sea level shows this decrease.

In most instances powers ranging from 60% to 75% of the engine rating are used for normal cruising operation. Considering 75% or 600 b.h.p. as a maximum, a similar power limitation can be made by using a regulator set to maintain a pressure equivalent to the critical altitude for this condition. Considering 2180 r.p.m a desirable engine speed for cruising, it is found by again referring to figure 3 that the critical altitude for this condition is 11,700 ft. Normally a pressure regulator is fixed to maintain only one pressure but it would be desirable to have a double range of pressures available.

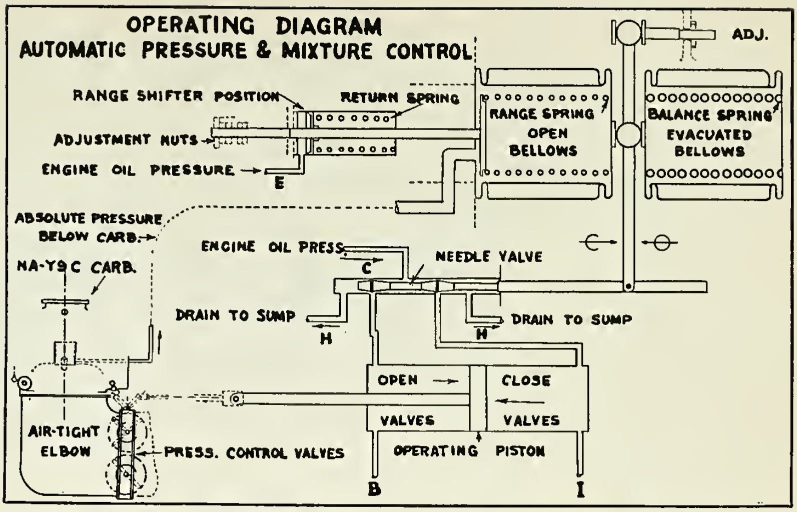

Figure 5. Operating diagram

It was found during early development work of some supercharger pressure regulators that, due to the method employed to actuate the servo piston, deviations exceeding 1″ of mercury existed, depending on the position of the servo piston. The use of this regulator would have meant approximately 5% power variation and 3% fuel consumption variation, assuming everything else perfect. Being unwilling to accept such inherent variations, the first step was to develop a more suitable pressure regulator. In doing so the additional feature of a double range was included.

Various means for positioning the carburetor mixture control valve were tried both with back suction type and needle type controls. During all the attempts at positioning the mixture control valve it was realized that the general shape of the fuel curve of figure 1 would be maintained. As pointed out the enrichment from 2180 r.p.m. on to full throttle is only necessary due to the increased power. If full throttle power does not exceed that obtained at 2180 r.p.m. at sea level there is no need for the enrichment and a curve like the lower dotted line would be more desirable. As evident from figure 3 if the pressure in the carburetor is restricted to the equivalent of that at 11,700 ft. this power can never be exceeded. If, therefore, instead of the usual economizer action, a system of poppet valves controlling jets were to be used the enrichment could be eliminated when the power limitation so warranted. Of course sufficient jet capacity must still be provided when maximum allowable power is available. Thus, at maximum power the fuel curve would be similar to the upper dotted line in figure 1. With such an arrangement excess fuel is provided if operating at part throttle with a 7,000 ft. power limitation, but this can be avoided by shifting the setting of the device to 11,700 ft. and using full throttle.

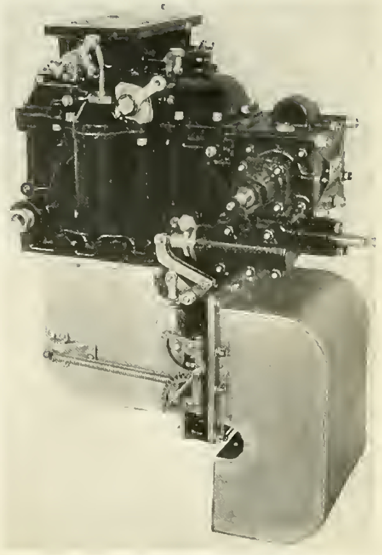

Figure 4. Present production apparatus with Stromberg carburetor and Eclipse regulator

A present production apparatus (figure 4) is the Stromberg Model NA-Y9C carburetor with an Eclipse Model 3105B regulator mounted on the rear. Shown here is an elbow air scoop below the carburetor with the air valve assembly in place. The operating linkage between the regulator and the air valve assembly is also visible. It is intended to make the air valves integral with the carburetor, but with the present type of carburetor construction, excessive variations in metering were experienced with the valves located in this position.

Figure 5 shows that the principal operating parts of the regulator consist of two bellows, a lever arm actuated by any movement of the bellows and a needle valve directing oil to the two sides of the operating piston. Of the two bellows one is evacuated and spring loaded internally and the other vented behind the venturis in the carburetor thereby being affected by the average carburetor air horn pressure. If the absolute pressure in the air horn is such that the evacuated bellows is collapsed, the lever arm is drawn to that side and, being fixed at the top, draws the needle valve to that side. This action admits engine oil pressure to the back side of the operating piston at the same time opening the opposite end to drain, all of which forces the operating piston outward and through suitable linkages, closes off the pressure control valves in the carburetor. As these valves are closing, the absolute pressure in the air horn is being reduced. When this pressure reaches a value such that the open bellows tends to collapse, thus expanding the evacuated bellows, the needle valve is thereby moved. During this movement there comes a time when the needle valve is in its central position thus holding the operating piston and air valves stationary.

Necessary dampening is provided by the taper on the needle valve. Tests were made to determine the extent to which the regulator would overshoot the mark and a taper provided which would slow down the action near the balance point to slightly reduce the overshoot. The net result was to reduce the speed of action only when within ½" of mercury of the balance pressure.

The absolute pressure to which the unit regulates depends on the strength of the springs in the evacuated and open bellows. An increase in spring compression in the open bellows changes the absolute pressure for balance to a lower value. This feature is used to enable the same regulator to control two different pressures and is accomplished by the range shifter piston operating on the spring in the open bellows. Adjustable stop nuts limit the travel of the range shifter piston in both directions.

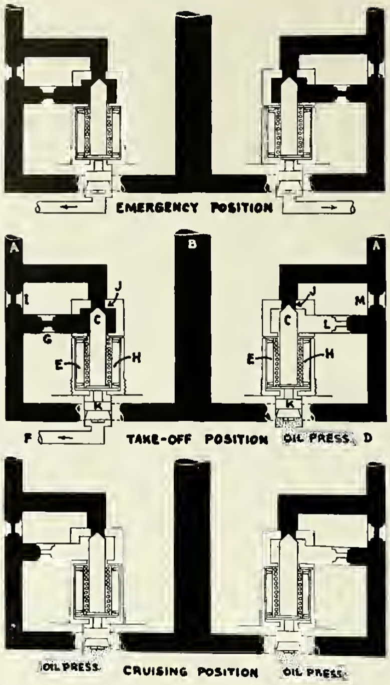

Figure 6. Operating diagram, automatic mixture control carburetor NA-Y9C. (Black areas indicate fuel) A—Fuel from float chamber. B—To main discharge nozzle. C—Valve. D—R.H. oil pressure from selector valve. E—Fuel and oil seal bellows. F—L.H. oil pressure from selector valve. G—Take-off jet. H—Valve return spring. I—L.H. cruising jet. J—Valve seat. K—Servo-operated pistons. L—Emergency jet. M—R.H. cruising jet

Figure 6 shows diagrammatically the jet and passage arrangement in the carburetor. The two outside passages are directly connected to the float chamber providing the fuel feed to the jets. The two cruising jets *I* and *M* are directly in these outside passages and the two auxiliary jets are located in a by-pass passage arrangement around jets *I* and *M*. The auxiliary jets *G* and *L* are cut in or out of action depending on the position of the poppet valves marked *C*. After passing through the jets the fuel goes across the lower passages to the center and up the central passage to the main discharge nozzles. For simplicity in explanation, the cruising position will first be considered. Here the regulator is maintaining a pressure equivalent to an altitude of say 11,000 ft. This means that the density in the carburetor is greatly reduced. On a normal carburetor that would require the use of some mixture control. In this carburetor, jets *I* and *M* are selected to give the desired consumption at this altitude, the other two, *G* and *L* being cut off due to the poppet valves *C* being closed. As the regulator will maintain a constant pressure in the carburetor, these two jets will give uniform metering at any altitude below that for which the device is set.

In the take-off or maximum allowable power position (sometimes used as high power cruising position) the regulator is maintaining a pressure equivalent to a somewhat lower altitude, say 7,000 ft. This necessitates additional jet capacity in the carburetor due both to the decrease in altitude and to higher power being available from the engine. To accomplish this, jet *G* is brought into action by relieving the oil pressure holding the poppet valve on its seat thus allowing the spring to open this valve.

In addition to the two regulated positions an emergency position is provided where the regulator is inoperative and atmosphere air has free entrance to the venturis. Under this condition a further increase in jet capacity is obviously required. This is accomplished by bringing jet *L* into action by relieving the oil pressure holding the poppet valve controlling this jet on its seat. By the proper selection of the various jet sizes, any desired fuel consumption for the three possible operating conditions is obtained.

Figure 7 shows the passages leading to and from the selector valve and the method in which the selector valve interconnects them. In the emergency position oil pressure is applied only to passage *B*, which is directly connected to the opening side of the operating piston. All other pressure passages are blocked off. Similarly, in this position all drainage passages are open except the drain from the needle valve. By applying pres-

(*Continued on following page*)

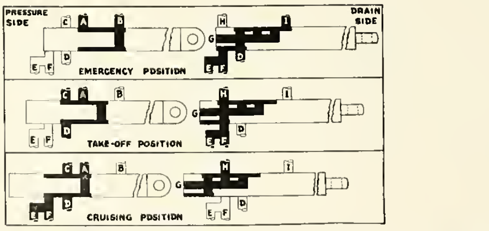

Figure 7. Selector valve operation, automatic pressure and mixture control. A—Engine oil pressure. B—Direct pressure to opening side of operating piston. C—Pressure to needle valve. D—Emergency carburetor jet. E—Range shifter piston. F—Take-off carburetor jet. G—Drain to sump. H—Drain from needle valve. I—Direct drain from closing side of operating piston

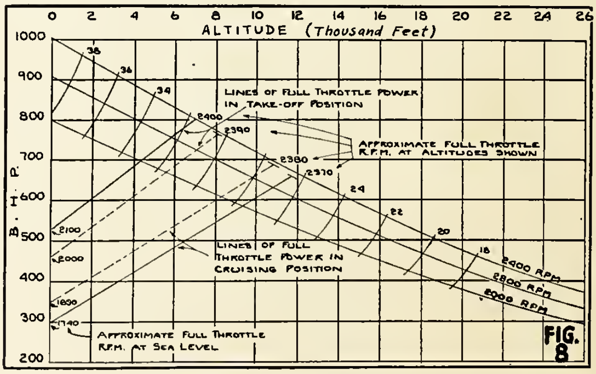

FIG. 8

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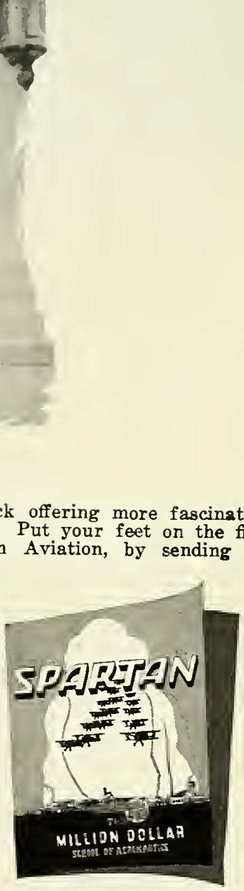

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(*Continued from preceding page*)

sure to one side of the operating piston and opening the other side to drain, positive opening of the pressure control valves is assured. The two jet operating pistons are both open to drain and being spring loaded, the needle valves are open giving maximum carburetor capacity.

In the take-off position the two direct connections to the operating piston are closed off and the pressure and drain connections to the needle valve are opened, thus putting the regulator into operation. Passage *E* to the range shifter piston is still open to drain, so the pressure maintained will be the higher absolute figure corresponding to the lower altitude. Only one of the jets has been cut off to compensate for the first altitude condition.

In the cruising position the only change from take-off is to shift the range spring so that regulation to a higher altitude is obtained and at the same time cut out the second needle controlled jet thus giving the proper carburetor metering for the regulated altitude. This is done by connecting passages *E* and *F* to pressure instead of to drain.

During flight tests with a power and mixture control unit set to a critical altitude of 7200 ft., a test was made to determine at what altitude the manual mixture would be required. With the control delivering a lean best power mixture when below the critical altitude, full rich operation was checked at several altitudes and not until 15,000 ft. was it noted that the engine tended to increase in r.p.m. when leaning out. Theoretical calculations based on these figures indicate that with a critical altitude of 11,000 ft., best power operation should be experienced without manual mixture adjustment to approximately 20,000 ft. Since full throttle power decreases at a greater rate than the fuel-air ratio increases with altitude, hourly consumptions experienced when flying above the critical altitude of the control will decrease with increases in altitude.

The power control obtainable when this device is used on an engine having a constant speed propeller is shown in figure 3. If on the other hand a two-position or fixed-pitch propeller were used, results similar to those shown in figure 8 might be expected. Here, because of the rapid change in engine r.p.m. with changes in altitude, a greater power variation is experienced. It would probably be desirable to provide two cruising positions as here shown by the dotted lines. Even though this would destroy the advantage of power control at take-off it would provide a more useful arrangement for general operation.

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Biplane of Infinite Span

Contribution to the Experimental Study of a Biplane with Infinite Span (Contribution a l'étude expérimentals du biplan d'envergure infinie), H. Girard. Publications Scientifiques et Techniques du Ministère de l'Air, No. 53 *(Two Volumes),* 1934, *(published January* 30, 1935), *Vol. I,* 132 *pp.,* 57 *figs.,* 6 *diagrams, Vol. II,* 75 *figs.*

THREE PARTICULAR cases of biplanes with equal wings of the same profile and differing only in wing gap, parameter, stagger and decalage were studied for this report. The author defines the conditions for obtaining unit coefficients independent of the geometrical aspect ratio of the model and for finding the infinite experimental aspect ratio, and applies the method to 125 biplane cellules. The diagrams of the pressure distribution are comparable between the lower surface of the lower wing and the lower surface of the monoplane, as well as between the upper surface of the upper wing and the upper surface of the monoplane, while the upper surface of the lower wing is very different from the upper surface of the monoplane, and the under surface of the upper wing from that of the monoplane.

The laws of Prandtl relative to the aspect ratio of biplane wings are verified. The study of the different mathematical theories for the biplane of infinite span shows that they are only those of the first approximations which do not show the variation of the angle of no lift nor the negative drag at no lift. The second volume is devoted to 75 polar curves indicating the influence of wing gap, stagger and decalage.

Airfoil Data

Tests of Six Aerofoil Sections at Various Reynolds Numbers in the Compressed Air Tunnel, E. F. Relf and R. Jones. (British) Aeronautical Research Committee—Reports and Memoranda No. 1627, *September* 22, 1934 *(Published April* 26, 1935), 28 *pp.,* 6 *figs.*

AERODYNAMIC DATA is given for six airfoil sections, namely the R. A. F. 28, R.A.F. 38, R.A.F. 48, R.A.F. 34, Clark YH, and Goettingen 387, which were tested in the compressed-air tunnel over a wide range of Reynolds numbers. With the corrections accounted for, except for possible effects of tunnel turbulence, the results as given apply directly to free-air conditions at the Reynolds numbers tested.

Aerodynamics

An Experimental Investigation of Boundary Layer Flow with Special Reference to Methods of Detecting the Transitional Region, L. F. G. Simmons and A. F. C. Brown. (British) Aeronautical Research Committee—Reports and Memoranda No. 1547, *November,* 1929 *(Published April* 24, 1935), 18 *pp.,* 28 *figs.*

AN INVESTIGATION to develop more expeditious methods for detecting the presence of turbulence in the boundary layer is described. Several methods were examined and it was found that the results obtained when a hot-wire anemometer was used as a detector were in good agreement with those determined from measurements of the velocity gradient at the surface and from explorations with a total-head tube made along a path at a fixed distance from the surface of the model.

Ignition Timing

Consumption Measurements in Flight with Variable Ignition, J. L. Hutchinson and E. Finn. (British) Aeronautical Research Committee—Reports and Memoranda No. 1612, *December,* 1933 *(Published April* 24, 1935), 8 *pp.,* 15 *figs.*

THE EFFECT of ignition timing upon the range of aircraft with an air-cooled engine was investigated on a Stag J-7028 Jupiter VI airplane. It was found that the effect on range with the weakest mixture was the same at all heights tested. The gain in economy at 2,000 ft. with any fixed ignition setting between 35° and 51° advance, due to the use of the intermediate and weakest mixture, instead of the normal weak mixture was 5 and 10 per cent, respectively.

High-Speed Wind Tunnels

Aerodynamic Tunnels for High Velocities (Gallerie aerodinamiche per alte velocità), L. Crocco. L'Aerotecnica, Vol. 15, *No.* 3, *March,* 1935, *pp.* 237-275, 5 *figs.*

VARIOUS TYPES of experimental wind tunnels are compared and the principles for designing those operating at supersonic speeds are discussed. By simplifying hypotheses for the transformations taking place in the various portions of the tunnel and for the corresponding losses, the author establishes a homogeneous system of formulas for determining the efficiencies and powers required for the unit section of the working portion of the tunnel. Numerical applications of the formulas show the marked superiority of wind tunnels in which the energy compensating the losses is supplied directly, over those in which the compensation is performed indirectly, as well as the suitability of the closed-jet types which allow a reduction of power required by decreasing the pressure in the channels.

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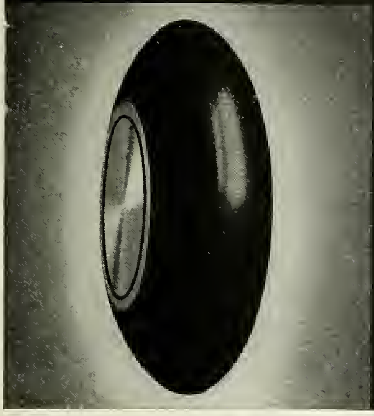

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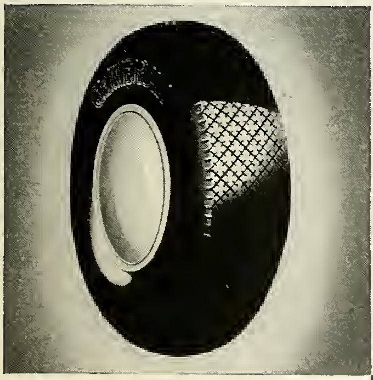
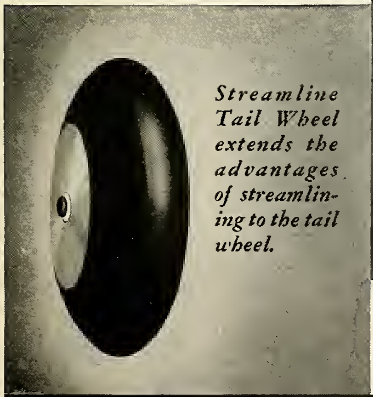
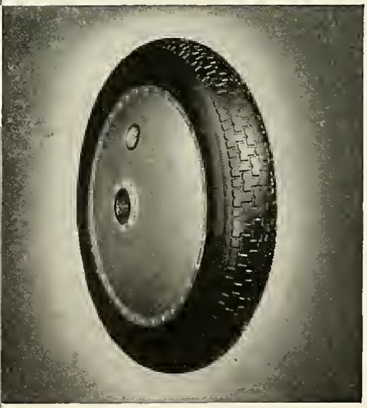


General Intermediate type combines low pressure advantages with long life and rugged service construction.



Streamline Tail Wheel extends the advantages of streamlining to the tail wheel.



General High Pressure type: the service life of this tire reflects General's long experience in building airplane tires of all types.

GENERAL TIRE & RUBBER CO.
AKRON, OHIO

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BREDOUW-HILLIARD AERO-MOTIVE SERVICE, Inc.
KANSAS CITY, MO.

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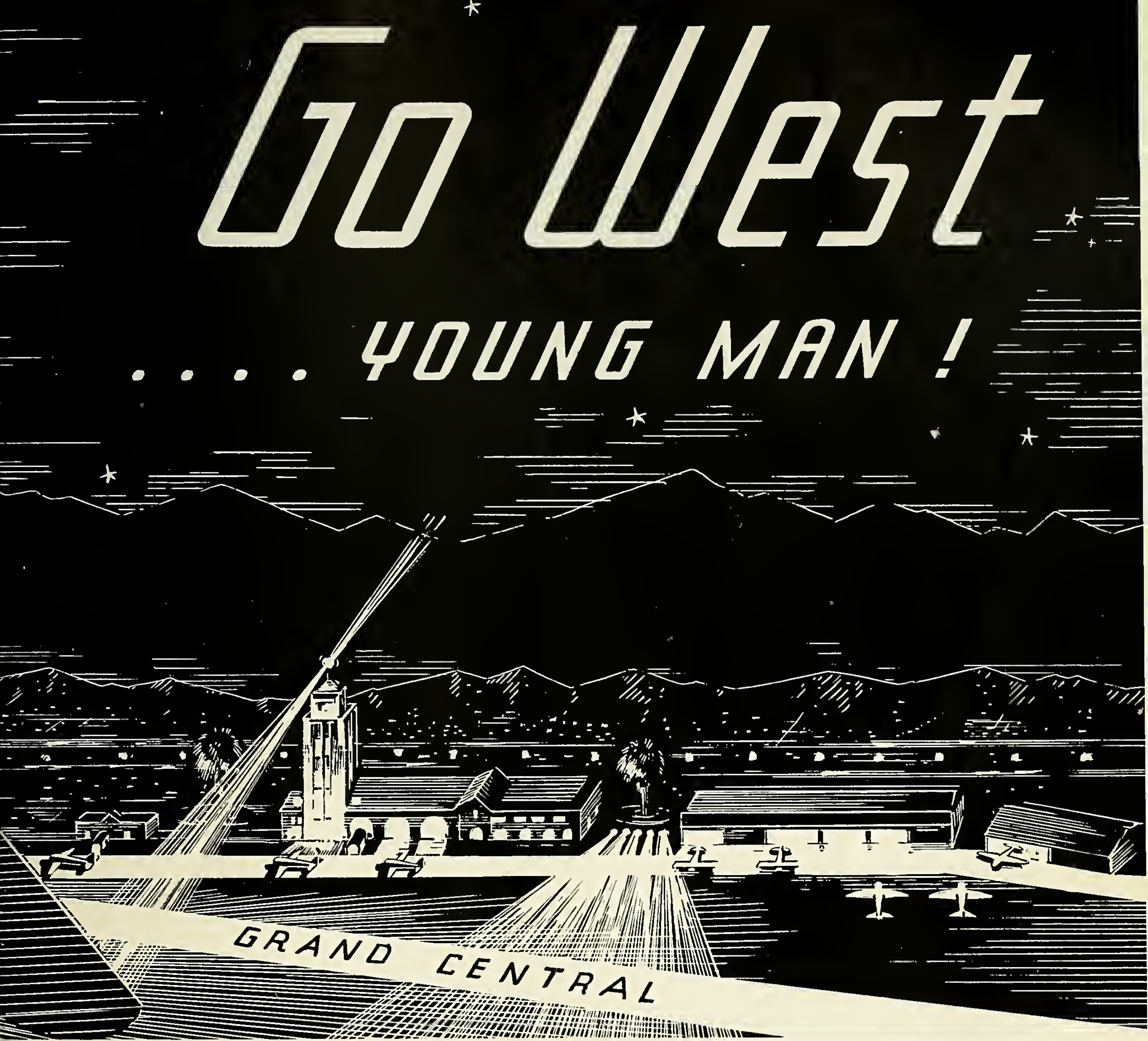

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Curtiss Type III HAWK

Powered with the New 750 H. P. Wright Series F-50 Cyclone Engine

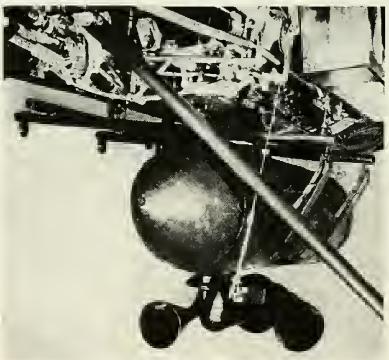
● Showing a top speed of 244 miles an hour at 10,300 feet, and the ability to climb to that altitude in less than 5 minutes, the new Curtiss Type III Hawk is announced by the Curtiss-Wright Export Corp., New York, N. Y. The latest Navy version of the Hawk pursuits is the Curtiss BF2C1, a squadron of which constitute the single-seat fighter element of the U. S. aircraft carrier *Ranger.*

Due to a retractable landing gear, improved streamlining, and the use of the new 750 h.p. Wright Series F-50 Cyclone engine (which features the Wright Dynamic Damper) this single-seat pursuit biplane attains a maximum speed of 233 m.p.h. at 16,500 ft. (5000 meters), and 204 m.p.h. at sea level. It can climb to 13,120 ft. (4000 meters) in a little more than 6 minutes, 16,400 ft. (5000 meters) in 9 minutes, and to 19,680 ft. (6000 meters) in less than 13 minutes. Built especially for high altitude fighting and bombing, the Type III Hawk is designed and constructed to withstand the stress of terminal velocity dives. It has a wing span of 31 ft. 6 in., and an overall length of 23 ft. 6 in.

The fuselage is of steel tubular construction manufactured in three welded assemblies which are riveted together. Front and rear sections are also of tubular truss construction. Joints are welded, and complicated fittings are of steel forgings welded to the tubes. The entire structure is fabric-covered.

Cockpit design affords the pilot excellent vision; in addition, it is shielded to provide comfort. Instruments and firing control mechanism are placed so that they are in the most accessible position.

The engine mount is a welded tubular structure consisting of an engine mounting ring supported by a truss structure which is attached to the fuselage fittings with bolts. Rubber blocks, held in sockets in the engine mounting ring, not only permit more flexible connection between engine and mount, but reduce vibration.



Bomb racks are adaptable for the use of smoke screen apparatus containing sufficient chemical for a 4500-foot screen

Structure in the upper and lower wings is identical. Spars are of hollow box section with spruce upper and lower flanges and plywood web, each spar being internally braced and reinforced. Ribs are built up wood trusses using spruce flanges and diagonal bracing and plywood webs.

Diagonal drag trussing between spars is of steel tie rods, and welded steel fittings formed about the spar and bolted through it, provide for the attachment of struts, wires, etc.

Ailerons, mounted on the upper wing only, are built of aluminum alloy sheet covered by fabric. They are attached to the wing by ball bearing hinges and are dynamically balanced. The leading edge of both wings, from the front spar around the nose ribs, is covered with a fairing of dural sheet.

The upper wing, which is one continuous panel tapering in section, attaches to the fuselage by a cabane structure of streamlined *N*-type struts and wires. The inboard end of each lower panel is attached to the fuselage by steel hinge pins through fittings on the front and rear parts. *N*-type interplane streamlined struts of steel tubing are employed.

The tail unit is of all-metal construction, having spars of molybdenum steel tubing and ribs of duralumin. All are fabric-covered. The fin is adjustable on

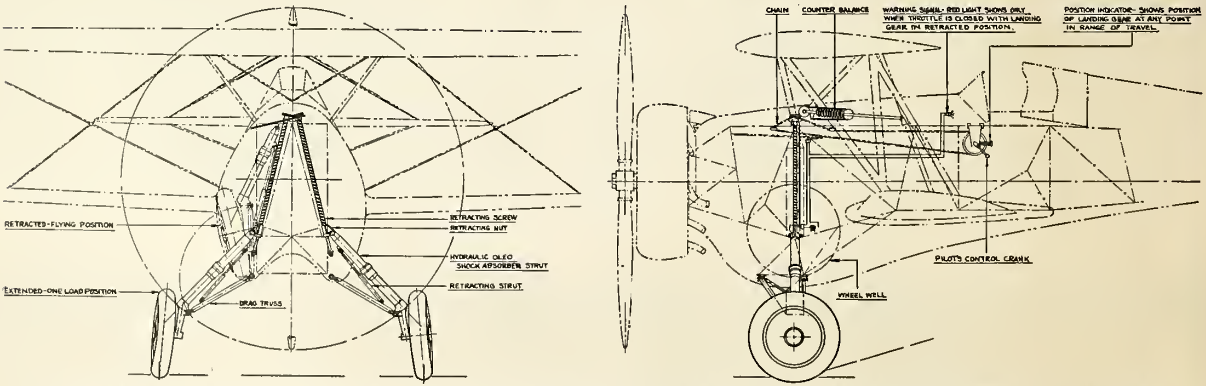

RETRACTED-FLYING POSITION
EXTENDED-ONE LOAD POSITION
DRAG TRUSS
RETRACTING SCREW
RETRACTING NUT
HYDRAULIC OLEO SHOCK ABSORBER STRUT
RETRACTING STRUT
CHAIN
COUNTER BALANCE
WARNING SIGNAL- RED LIGHT SHOWS ONLY WHEN THROTTLE IS CLOSED WITH LANDING GEAR IN RETRACTED POSITION.
POSITION INDICATOR- SHOWS POSITION OF LANDING GEAR AT ANY POINT IN RANGE OF TRAVEL.
PILOT'S CONTROL CRANK
WHEEL WELL

Diagram showing the general arrangement and method of operation of the Type III Curtiss Hawk retractable landing gear mechanism the ground, and the stabilizer is adjustable in flight from the cockpit. All controls are mounted on ball bearings.

The retractable landing gear is one c the features of the Type III Hawk. Eac side of the landing gear is an individu unit, which consists of a welded ste drag truss of fixed length. This tru hinges, on one end at two fittings on t lower portion of the fuselage side trus and on the other end, at the shock al sorber strut by a horizontal pin join Landing loads are absorbed by the h draulic oleo shock absorber strut whic extends from the pin joint on the dra truss to a retracting nut in the fuselag The axle is rigidly attached to the low or overhang portion of the oleo strut.

An internally-threaded retracting n on the top of the oleo strut is mounte on a retracting screw, supported in a ve tical position on bearings in the fuselag Rotation of the retracting screw raise the oleo strut and the outer end of th drag truss. Angular movement of the drag truss swings the lower end of the oleo strut inward until the wheel rests in a "well" in the side of the fuselage, thus providing an unobstructed surface for the airflow at that point.

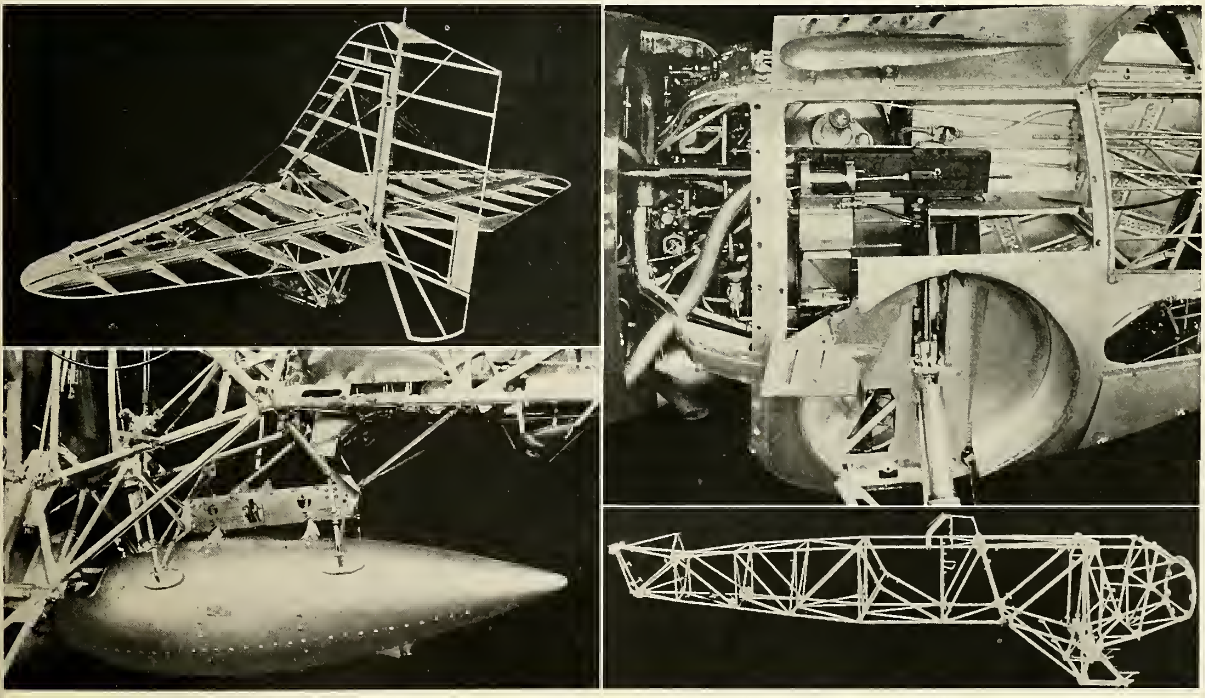
Wheels are mounted on roller bearings. They carry 32″ × 6″ tires, and are equipped with brakes operated either individually or together from the cockpit. The tail skid is of the full-swiveling type, but may be locked in a straight fore and aft position by a control in the cockpit. If desired, the skid can be replaced by a hard rubber tail wheel.

Normal load carried in the two fuel tanks is 110 gallons, sufficient for a range of 561 miles (903 kilometers) at cruising speed. This range may be increased to 812 miles by carrying a 50-gallon auxiliary tank.

Fittings are provided under each lower wing panel for the installation of bomb racks designed to carry five 10 kg. bombs, three 20 kg. bombs, or two 50 kg. bombs. In addition, the plane usually carries two fixed machine guns, mounted on either side of the fuselage.

Specifications and performance figures of the Curtiss Type III Hawk are as follows:

Wing span	31 feet 6 inches
Length overall	23 feet 6 inches
Height overall	9 feet 11.5 inches
Wing area	262 square feet
Power loading	5.43 lbs./h.p.
Wing loading	16.1 lbs./sq. ft.
Landing gear tread	7 feet 9 inches
Fuel capacity (normal)	110 gallons
uel capacity (maximum)	160 gallons
il capacity (normal)	9 gallons
il capacity (maximum)	13 gallons
mpty weight	3163 pounds
seful load	1067 pounds
ross weight	4230 pounds
aximum speed (10,300 ft.)	244 m.p.h.
aximum speed (16,400 ft.)	232.8 m.p.h.
aximum speed (sea level)	204 m.p.h.
ruising speed (10,300 ft.)	204 m.p.h.
talling speed (sea level)	67.8 m.p.h.
ritical altitude	10,300 feet
Time of climb to	
1000 meters (3800 ft.)	1.50 minutes
2000 meters (6560 ft.)	3.02 minutes
3000 meters (9840 ft.)	4.72 minutes
3050 meters (10,000 ft.)	4.8 minutes
4000 meters (13,120 ft.)	6.68 minutes
5000 meters (16,400 ft.)	9.08 minutes
6000 meters (19,680 ft.)	12.45 minutes
Service ceiling	25,800 feet
Absolute ceiling	26,650 feet
Cruising range (normal fuel) at 10,300 ft.	561 miles
Cruising range (maximum fuel)	812 miles



Curtiss Type III Hawk tail assembly; 50-gallon fuel tank on bomb rack; machine gun above wheel well; and fuselage skeleton

NEW EQU METHODS

Semi-Automatic Transmitter Tuning

• IN CHANGING transmitter tuning from one wave length to another it is desirable to effect the change in the shortest time. This is especially true in airway communications where a ground station may be transmitting weather reports on one wave length, a direction beam on another and talking with pilots aloft on another. It is also essential tha
the transmitter be returned to identically the same wave length each time the same information is again being broadcast to make it easier for the pilots to tune thei
receivers.

To accomplish semi-automatic tunin
of the transmitter, a six position selecto
switch mounted on the control panel, pro
vides for selection of any one of five cir
cuits and an off position. Selection of any one circuit may be made from any previous position of the switch without closing any other circuit. A relay is used to connect the transmitter for the desired wave length; it consists of five independently operated relays mounted side-by-side, each having three normally open poles. The contacts short-circuit various sections of the tuning coils and are located as close to the coils as possible to reduce capacity effects and prevent inductive coupling.

Struthers Dunn, Inc., of Philadelphia, Pa., supply this, and other similar equipment.

Pick-Proof Lock

• DUDLEY LOCK Co., Chicago, Illinois, has developed a new lock which is claimed to be drill-proof, grip-proof, jimmy-proof, and force-proof.

The copy-proof Dudley key has a design that prevents spurious duplication. It has a four edge key, operating four sets of pin tumblers, instead of one, in the core, providing an infinite number of key changes.

The lock can be used for mail or freight compartments and it may also be applied to mail sacks in addition to hangar doors, lockers, offices, etc.

Light Metals Arc Welder

• A LOW current arc welder capable of handling light gauge metals has been made available by the Harnischfeger Corp., Milwaukee.

Known as the P&H-Hansen 50 Ampere vertical model W50-254, this welder, is a stable high speed arc which enables it to weld quickly and efficiently down to 26 gauge steels. No external reactors,

license a new
acon in which the lenses form a sphere and concentrate the light into three beams. It rotates at 6 r.p.m. and gives two flashes per revolution, a clear flash and a color flash that designates the type of field. The light dims between flashes but is always visible, eliminating confusion with all other flashing lights including marine beacons. The main beam

Three-beam revolving aircraft beacon

which is of 125,000 candlepower with a 100 watt bulb, has been seen for 40 miles; it's angle is adjustable. The second beam flashes at all angles of approach, a new feature which makes this unit suitable for use in mountainous country and around cities. The third beam is a revolving ceiling light.

The beacon comes complete with built-in motor and transformer, ready to operate from 110 volt A. C. circuit.

ircraft ransmitter

A NEW long distance telegraph trans-
itter weighing 15 pounds and deliver-
ıg a nominal 75 watts of continuous
ave radio frequency power to the an-
nna, has been developed by the Chico-
ee Falls, Mass., radio division of
estinghouse Electric & Manufacturing
ompany. Known as the Model CH, the
ansmitter represents 5 watts for each
und of transmitter unit, and operates
six frequencies, by means of plug-in
il assemblies.

The five-tube set operates from the
-volt battery system of the plane
rough dynamotor, or a low plate sup-
ly voltage of 500.

The dynamotor, specially designed for
ircraft service, is light in weight, but rugged. The use of magnesium alloy castings, has resulted in a machine of 13½ lbs., capable of delivering 150 watts of 500-volt power to the transmitter.

The coil systems range from 2700-3450 kc; 3450-4420 kc; 4420-5890 kc; 5890-7410 kc; 7410-8620 kc; and 8620-9700 kc.

The equipment is of splash-proof construction. Provision for ventilation and cooling of the transmitter is made by means of louvres in the sides, small openings in the bottom, and drip-proof ventilators at the top. The dynamotor unit is totally enclosed to eliminate the possibility of the introduction of foreign matter.

A normal output of 60 to 75 watts in the frequency band of 2700 to 10000 kc., may be obtained with a 16-ohm antenna. The equipment is so designed that neither tubes nor transmitter are damaged if the antenna should become grounded or open-circuited.

The horizontal-type construction, employing chassis and sub-base is used, with most wiring, resisters, and bypass capacitors located beneath the chassis base. The cover for the transmitter upper compartment is screwed to the chassis and has a hinged lid for access to plug-in coils and tubes. The bottom of the chassis is covered with a protection plate, designed also to accommodate a shockproof mounting. Wing nuts and studs attached to the baseplate, hold the transmitter assembly in place on shockproof base, allowing quick change-over of transmitter.

The shockproof unit for the transmitter, designed to screw or bolt securely to the mounting board in the plane, consists of 4 molded rubber cylinders contained in removable aluminum cans, these units being attached to the underside of the transmitter sub-baseplate.

(*Continued on following page*)

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"DIGEST OF AIRCRAFT & ENGINE MATERIALS"

NEXT ISSUE

NEXT ISSUE

THE aviation industry's technical progress during the past few years is a story of notable achievement. Behind that progress there is another important story—the cooperation aviation receives from the industries supplying its materials of manufacture. It is a story of scientific selection—the cumulative experience of the most highly skilled personnel in combination with the latest developments in equipment and manufacturing methods.

The exacting demands of the aviation industry are an incentive and a challenge to the ingenuity of the producers of its raw materials and fabricated parts. As a result of their matured experience, extensive facilities and specialized equipment, these older industries are furnishing materials which make the airplane the highly efficient vehicle it is today.

We will make the close relationship between industries the theme of the "DIGEST OF AIRCRAFT & ENGINE MATERIALS." Illustrated feature articles by outstanding authorities in their respective fields will deal with interesting phases of the subject.

So many industries are allied with aircraft and engine construction, and the sources of supply are so scattered—many of them obscure—that a directory of these sources is needed at this time. *Since no such reference exists, the July* AERO DIGEST *will include a comprehensive list of the producers of raw materials and fabricated parts, their plants, branch offices and personnel concerned with aeronautics.*

George F. McLaughlin
—EDITOR

AERO DIGEST in July will present another of its distinctive issues—describing *for the first time* the relationship between aviation and the industries which furnish its materials of manufacture: aluminum, steel, brass, bronze, wood, fabric, paint, glass, rubber, etc. Technical authorities will discuss such topical subjects as corrosion prevention . . . metals used in aircraft engine construction . . . fittings—castings, forgings, etc. . . . metal construction . . . stainless steel . . heat treatment . . . non-ferrous metals in aircraft construction . . . Army and Navy standards . . . etc., etc. « A separate section will contain *the first and only* directory of the aviation industry's sources of supply of raw materials and fabricated parts—a directory which will prove infinitely useful to those who are engaged in the manufacture, maintenance and operation of aircraft, engines and accessories. « If you have been buying AERO DIGEST on the newsstands you will recall, no doubt, how shortly after publication the April *Digest of American Aircraft, Engines, Accessories* was sold out. Don't take a chance next month—SUBSCRIBE NOW; and, incidentally, save yourself $1.20 a year —or $3.40 over a period of two years.

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(*Continued from preceding page*)

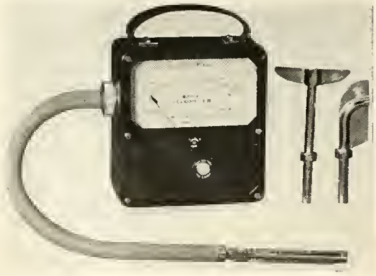
Boyle Velometer

• THE BOYLE Velometer, offered in two types, each with a double range scale, by the Illinois Testing Laboratories, Inc., Chicago, Ill., is a direct reading air velocity meter which gives accurate and instantaneous readings of the speed and direction of air motion measured in feet per minute.

Housed in a black bakelite case 5¼" × 5¾" × 3⅜", the instrument weighs approximately 2 lbs. Air enters through a port, or a jet and tube (depending on the style used) and leaves through a port on the right side of the meter. This air passing through the meter actuates a movement comprising a vane, control springs, pointer, and magnetic damping system. No mathematical calculations or stop watches are necessary to determine velocity readings, and a pointer locking button is provided to retain the reading or when the instrument is not in use.

The Shutter-Type is furnished with a shutter for opening or closing the port for changing the range and is not provided for tube attachment. This type is for taking quick commercially accurate readings such as in heating and ventilating and air conditioning work.

The Tube-Type Velometer is similar in size and appearance to the Shutter Type. When used for the low range readings, the tube attachment is removed and the air enters directly through the port. For high range readings, tube attachment with a suitable jet is used. The air enters through this jet. As the tube is flexible the jet can be moved about as required with the instrument held stationary if desired. With the Tube Type Velometer accurate velocity readings of the discharge or suction of grilles, ducts, or other restricted and small openings can be easily and quickly obtained. In addition to being exceptionally useful for heating and air conditioning service, this unit fills a need in industrial plants for determining air movements in dryers, kilns, or other like equipment. Special scales and attachments can be built for applications such as high velocities, high temperatures, and similar service.



Boyle tube-type Velometer

The standard scale range is 0-300 and 0-3000 ft. per min. although other ranges are also offered. The low scale on either type provides accurate readings as low as 20 ft. per min.

Light Metals Welder

• A SMALL, low-priced motor generator type of arc welding machine is announced by the Lincoln Electric Co. Known as the SA-100, this unit delivers as low as 30 amps. at the arc without auxiliary devices.

It is of motor-driven type, with a 30 to 125 amp., current range. The generator is of single operator variable voltage type with 100 amp. NEMA rating. Easy welding is assured by dual control which provides independent adjustment of open circuit voltage and welding current.

The welder is normally 220 or 440 volts and can be furnished for 110 or 550 volts, 3 or 2 phase, 60 and 50 cycles as desired. Connections are available for reconnecting from 220 to 440 volts, or vice versa.

Sheet metal shops and others, called upon to weld thin gauge materials, are enabled by the new welder to produce in thin sheets, plates and shapes the same high quality welds regularly obtained in heavier materials with the shielded arc welding process. The new welder meets the demands for welding these materials with a current which is uniform and of proper characteristics for using the smaller sizes of electrodes.

Cleaning Solution

• CURRAN CORP. of Somerville, Mass., has marketed a new cleaning and degreasing fluid called *Gunk*, which displaces the use of gasoline, lye and soaps.

The solvent instantly converts mineral oils and greases into a water soluble state, and can be used on painted surfaces, radiators, chromium, wheels, chassis, motor blocks, etc. Cleansing is accomplished by spraying on the solution and rinsing the treated surface with cold water from a hose.

Tool Cabinet

• TOOL STORAGE for individual mechanics is available at low-cost with the Lyon Hanging Tool Cabinet which has been planned in cooperation with experienced shop and service men as a personal locker for each mechanic in the shop.

Containing two adjustable shelves and 6 sq. ft. of shelf space, the cabinet measures 24" × 12" × 33". It has a welded angle steel frame, heavy flanged doors, and a padlock attachment.

Lyon Metal Products, Inc., Aurora, Ill., are the manufacturers.

New Bearing Material

• TO MEET the needs for a better bearing alloy which will withstand continued high speed operation in the high compression engines operating at temperatures and loads of steadily increasing magnitude, the Research Department of the American Smelting & Refining Co., developed a cadmium-base alloy hardened with nickel. Used for the past 18 months, this alloy, known as Asarcoloy No. 7, showed low coefficients of friction and little tendency to cause sludging of lubricating oil when compared with conventional babbitts.

In appearance it is difficult to distinguish between babbitt and Asarcoloy No. 7. Microstructures also are similar except that cubes are the only phase found in the matrix of a normal Asarcoloy No. 7 bearing structure. Asarcoloy No. 7 contains approximately 1.30% nickel. Cubes are $\mathrm{NiC^{d}7}$; the matrix is the eutectic of cadmium and $\mathrm{NiC^{d}7}$, analyzing 0.25% nickel.

Like the conventional babbitt, cadmium-nickel may be varied somewhat in composition to obtain alloys with different physical properties. Properties suitable for bearings lie between approximately 0.75% and 3% nickel. As the nickel content increases, strength and hardness increase and the ductility decreases.

Unlike most cadmium alloys, cadmium-nickel bonds directly with steel so that the same composition in use for the bearing proper may be used for bonding. The bond differs from other bonds in that no chemical compound is formed at the bond, but nickel penetrates the steel slightly, much the same as in welding of nickel to steel, giving greater ductility than those bonds in which a chemical compound is formed.

Among the important advantages of the cadmium-nickel bearing alloys are great fatigue resistance, great toughness, low coefficient of friction, great strength, more ductile bond (the alloy being self-bonding) and higher melting point.

The accompanying diagram shows a few of the properties of the alloy as compared with a commonly used babbitt.

Asarcoloy No. 7 properties

		Asarcoloy No. 7	*Babbitt*
Brinell Hardness at	82° F.	33	24
" " "	212° F.	22	12
" " "	390° F.	7	4
Yield Point in Tension lbs./sq. in.		11,700	8,500
Elongation at	82° F.	19	10
" "	212° F.	36	24
" "	390° F.	111	86
Reduction of Area at	82° F.	43	12
" " "	212° F.	52	38
" " "	390° F.	76	76
Compression Strength (10% reduction in gauge length) lbs. per sq. in. at	82° F.	21,800	14,000
"	212° F.	14,300	8,300
"	390° F.	4,400	2,300

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4. Modern Instruments—Properly grouped on panel for ease of reading.

5. Fuselage and Tail Group—Well streamlined, of heavy chrome-molybdenum steel tubing. Wood faired. Large spoon, helical spring shock absorbing tail skids.

6. Double Drag-Wire Braced Wings—Solid spruce spars, heavy dural leading and trailing edge. All metal ailerons of corrugated dural.

7. External Wire Bracing—5/16" A.N. wires, for exceptional strength and safety in all maneuvers. Tail group also streamline wire braced.

8. Sound Engineering and Construction—Equal to any $5000 airplane on the market today, assuring superior performance.

9. Product of One Manufacturer—Entire unit built and assembled in one factory, affording convenience for service.

10. High Quality Finish—Fabric covered, with 7 coats best grade pigmented dope, water-sanded to a durable satin finish.

11. Keeps Step With Progress—The makers of Aeronca have never rested on their laurels. Constant research and development work maintains Aeronca leadership, keeps appearance and construction ahead of present-day standards.

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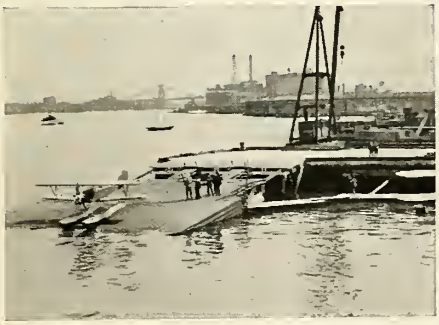

From busy office to summer home—from traffic's roar to breeze-swept pines on a secluded lake—in minutes. EDO ALL-metal Floats on your plane will link these extremes of business and recreation, make intervening miles a brief interval of exhilarating travel through the cool airways, assure the ever-present havens of the waterways beneath. EDOs—efficient, sturdy, dependable—are ready now in standard sizes for most well-known makes of airplanes and readily interchangeable with their wheel landing gear. Write today for complete information. Address, EDO Aircraft Corporation, 610 Second Street, College Point, Long Island, N. Y.

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Personairlities

By Caldwell

● THE LORD in His infinite wisdom knew that on Dec. 4, 1908, the United States Navy would be in need of one green apprentice seaman, so He prepared to fill that need by having Edward Nirmaier born at Cleveland, Ohio, Jan. 11, 1891. The Navy has never ceased to feel grateful for this small dispensation of Providence, and has set aside one day each year on which to return thanks. That was the start of Navy Day, according to information which I believe to be thoroughly unreliable.

Be that as it may, Eddie graced the public schools of Cleveland until he was 17, when the Navy got him and sent him to sea on the *Ohio*, *South Carolina*, and *Texas*, as those great battle wagons happened to be in need of a good man; and Ed was a good man, for he gradually worked up through all the grades to Chief Boatswain's Mate, whose duty it is to act as companion and chaperon to the Chief Boatswain, who otherwise might grow lonely, away out there on the heaving billows, a-defending his country and a-chewing Navy plug.

Eddie also spent a couple of years at the Naval Academy on the old *Hartford*, square-rigger, and about that time, around 1912, the Navy started an air base on the Severn River. They had three Curtiss E boats, which were pushers on floats, and Ed says it kept them busy picking these early pioneers out of the river, where they fell every so often. Ed says there were three pilots, John Towers, Pat Bellinger, and a Mr. Billingsley, who was born unlucky, apparently, for the Navy rigged up an air driven catapult and shot him from the deck of the *Hartford*, while the boys stood by with the wrecking barge. He went ten feet through the air and a proportionate number under the water, (due to the relative density of the mediums thru which he traveled), after which he was fished out. A few days later Mr. Billingsley, undaunted, went for a flight with Mr. Towers, and fell out from a height of 2,000 feet. And that was nearly twenty years before parachutes were issued. It took two days to find him, that time. Those times are what now are known as "the good old days" in aviation.

"... training on a rotary engine Caudron ..."

It was while he was a boatswain's mate on the *Texas* some years later that Ed requested a transfer to naval aviation at Pensacola. He was transferred in Dec., 1916, and joined the first enlisted class in aviation, emerging from the ground school in April, 1917, with an airman's certificate, just in time for the dear old war, which was started about that time to enable the United States to lose all of the money it had saved since the Spanish-American war—it not being considered a good thing for any country to be prosperous and out of debt. With 100 other hopefuls Ed landed at St. Nazaire, France, June 4, 1917, with the First Naval Aeronautic Detachment-Foreign Service, which was the first outfit of Americans, either army or navy, to land in France and learn to say *"Couchez avec moi,"* one of the more popular battle cries of the American Forces.

They were shipped to the French school at Tours and started training on rotary engined Caudrons, then were shipped to Hourtin, near Bordeaux, to take a few hours on F.B.A.'s, then on to San Raphael, near Nice, by which time only about 20 were left of the original 100. The rest had fallen martyrs to the French system of training, which consisted of a series of rides with a Frenchman who spoke no English, and who either had no dual controls or objected to the American using them. The hopeful pupil merely watched the Frenchman and then was turned solo, after which they either buried him some time during the next few days or else he staggered around in the air alone long enough to learn to fly. Eddie was one of the few eventual survivors of this Spartan system of instruction, all enlisted men, who were sent to Moutchic-Lacanau, where the first American seaplane school was started. There they stayed until the Armistice instructing Ensigns and Lieutenants by the score. They used French planes, D.D., Tellier, and F.B.A., until July, 1918, when they got a few American Curtiss H.S. boats.

After 14 years in the navy Ed Nirmaier retired to the Fleet Naval Reserve in July, 1922, and entered commercial aviation aboard a Curtiss F boat at Pensacola, sold out, and bought a Curtiss Seagull and got a job for himself and the boat with Gulf Coast Airways carrying mail from New Orleans to Pilottown. He made the initial trip on July 1, 1923, but got the wanderlust in the fall and put his wife and baby in the Seagull and flew to Miami, Florida, where he met the late Harry Rogers and teamed up with him. This association lasted several years, then he went off on his own again, at Miami, Palm Beach, Long Island, and Lake George. He was with the Curtiss Co. for some time, and put in the Miami base. When N.Y.R.B.A. line opened he became operations manager at Miami, and established the base which is now Pan-American's, then he went back with Harry Rogers at North Beach. He has now stopped taking jobs and has a position with Powel Crosley, Jr., president of the Crosley Radio Corp'n, who also owns and operates WLW broadcasting station, which operates on 500,000 watts and can be heard anywhere in the world. I've always thought it would improve radio considerably if they'd turn the power down to 5 watts when politicians and comedians go on the air. Mr. Crosley also owns the Cincinnati Reds, an airport at Sharonville, Ohio, another one at Vernon, Indiana, a Northrop Executive, a Douglas Dolphin, a cabin Waco, and several other nic-nacs, including the Crosley Aircraft Co. He is apparently a

(*Continued on following page*)

AMPHIBIANS to the front!

The Argonaut Pirate

**brings new horizons,
new flying pleasures
—at less than $5,000!**

The Picture Tells the Story!

WITH the motor and propeller aft, three passengers sit side-by-side in the *quiet* cabin, heated and ventilated for all-year comfort, and converse in normal tones.

Clear vision allows undivided attention to flying—unobstructed view of runway or water for take-off and landing, and no disconcerting exhaust noises or propeller whirr.

Present production is practically sold, so we urge you to place your order for early delivery. Write for the Pirate folder with full details, pictures, etc.

SPECIFICATIONS

3-place cabin flying boat type, pusher Amphibian (Menasco C4 PIRATE Engine, 125 H.P.). Span 35 ft. 4 in.; length 26 ft.; height overall 8 ft. 2 in.

Cruising range .... 500 miles

Maximum speed	120 MPH
Cruising speed	104 MPH
Landing speed	40 MPH
Rate of climb	1000 ft. per min.
Service ceiling	15,000 ft.
Gross wt., fully loaded,	1870 lbs.
Gasoline, 40 gallons	240 lbs.
Payload (in place of 2 passengers plus 100 lbs. baggage)	440 lbs.

Standard equipment includes starter, cabin heater, brakes, anchor, navigation lights; wobble pump, engine-driven fuel pump. Instruments: airspeed, compass, tachometer, fuel gauge, ammeter, voltmeter, altimeter, oil pressure, oil temperature, pitch and bank indicator, switch, fuel pressure.

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AIR LINE, Salt Lake City, Utah

T W A, INC., Kansas City, Mo.

UNITED AIR LINES
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LINEAS AEREAS
OCCIDENTALES S. A.
(Western Air Lines)
Burbank, Calif.

WEDELL-WILLIAMS AIR
SERVICE, New Orleans, La.

WYOMING AIR SERVICE
Casper, Wyoming

Every transport airplane on every airline in America is equipped with

**SCINTILLA
AIRCRAFT MAGNETOS**

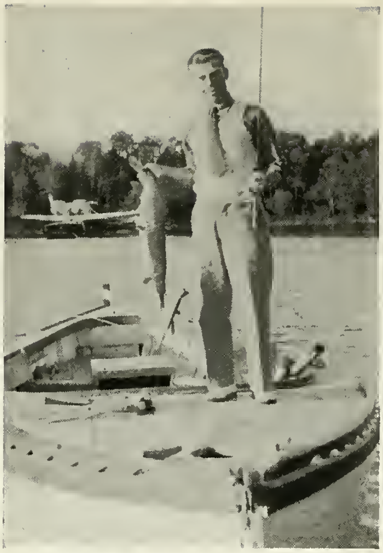
(*Continued from preceding page*)

rugged individualist. However, if the Democrats stay in office another presidential term I suppose Mr. Crosley will end up on Relief with the rest of us.

Ed Nirmaier has the softest position in aviation; Canada in the summer, Florida in the winter, and lots of hunting and fishing all the time, and getting paid for it. He even got paid to catch that fish that's posing in the picture with him. Well, he's earned a soft job, for he has done lots of hard work in aviation—over 6,100 hours now. And if he hasn't given his life to the science of aviation, he has at least donated a finger. In 1928 Lieut. Schilt, ex-Marine, flew a PAA Sikorsky to Belize, Honduras, and while there put his finger in a prop and had it cut off—the first finger on his left hand. Eddie, who was with Curtiss at the time, was asked to take that run the following Saturday. He landed at Belize, and while taxiing up the ramp the wheels broke through a plank. During the excitement of having a lot of natives running around shouting, gesticulating, and just missing the propellers, Ed pointed a finger at someone—the first one on his left hand. And by an odd coincidence he pointed it right through the track of the same propeller that had sliced off Lieut. Schilt's finger a week before! You know, if a fiction writer used a yarn like that, editors would give him the bum's rush. But you chaps know I always write the truth, unless someone has lied to me, in which case I write whatever I was told. But I believe Ed on that one. Anyhow, the finger is missing, and you can't simply lie a finger off yourself, you know that. But I've known Ed for nearly nine years now, and have always found him truthful. He never lies, except to his wife. He has had three wives now, in legal succession, which is conservative for an old Navy man with 6,100 hours. Wives do grow monotonous, and it seems reasonable to trade them in every 2,000 hours at the Women's Exchange.

George: (Insert slug—and be damned to you!)

(Ed. note to Cy) Oh, yeah? Some day I'm going to insert the damn and give you the slug! Just for that, here's half a propeller slug—and what are you going to do about it?



The one on the right is Eddie Nirmaier

● THE POSITION of the artist in aviation is a peculiarly happy one, though but little appreciated or understood. He, and he alone, is working not only for the present generation but for posterity. In even so short a time as fifty years probably everything that we know as aviation will have been swept away into the dust-bin of Time, to be replaced by new forms, new methods, new conceptions from the restless forward-reaching mind of man. Of the thousands of airplanes flying today none will remain but a few specimens in museums, pathetic reminders of our first attempts to conquer the air.

I have before me in my study a beautiful water-color by Alfred Owles which he was kind enough to send me as a mark of friendship; I have also an oil painting by Bill Heaslip, and a drawing by Leonard Bridgman of England. These pictures are my good friends; I live with them and enjoy their company. They are not mere reproductions or imitations of airplanes; they are an artistic manifestation of the life of aviation itself; in them there is the sense of speed and power and height above the petty annoyances of our ground life. They visualize for me not only what airplanes look like but also what aviation is; they mirror some of the courage and self sacrifice, some of the idealism that has enabled man to lift himself toward the skies.

Writing not for posterity but for six saddened and discouraged readers who each month grit their teeth and wade grimly through my columns, I shall now descend from the heights of artistic appreciation, whose rarified atmosphere ill agrees with me, and take a look at Alfred Owles, the artist and the man, his life and times. It is a somewhat discouraging prospect. To look at the valiant picture he has given me, of four pursuit ships among the clouds, you might think the artist was a roaring, swash-buckling blade, tearing through war-torn skies, descending only to carouse in the mess, then again leaping to the fray, his machine-guns spitting death and destruction at the foe. Unfortunately, Mr. Owles does not quite come up to this artistic hope of ours; he is, I regret to admit, a quiet fellow. Even a tame one. His adventuring is all done on paper and canvas, with brushes.

He entered life unobtrusively in the city of Nottingham, England, on July 4, 1894. The fourth of July, I might add, is not set apart in England as a day of rejoicing, so no fire-crackers attended the arrival of the infant Owles. Mr. Owles, Senior, merely groaned quietly and repaired to the Black Boy Inn and bought himself a drink. Years later, in 1917, when I was a downy-faced Second Lieutenant in His Majesty's Royal Flying Corps, I also was wont to repair to that same Black Boy for a drink, though at that time I was not yet a parent. However, I have never needed fatherhood as an excuse for drinking; I drank even when I was a bachelor and mightily enjoyed it, though I do not recommend the practice to young men entering aviation today, for our industry has become very sober and respectable.

There evidently was insanity in relatives of the Owles family, for Alfred writes me that an uncle of his was trying to perfect perpetual motion, monkeying around with sulphur potash and carbides. Alfred entered into the spirit of the thing, helped his uncle in his experiments, and blew out the kitchen window. This cured him of inventing and turned him to Art. He had no proper drawing materials, or money to procure them, so he drew on anything white, including the blank pages at the front and back of church hymn books and the family bible. His father blessed these endeavors by the laying on of hands, at the rear, after which Alfred pursued his artistic career on paper in which the family meat and groceries had been wrapped. You know, I often get letters from young men bewailing the hardness

(*Continued on page* 78)

Al Owles, hard at work

FISHER RESEARCH LABORATORIES

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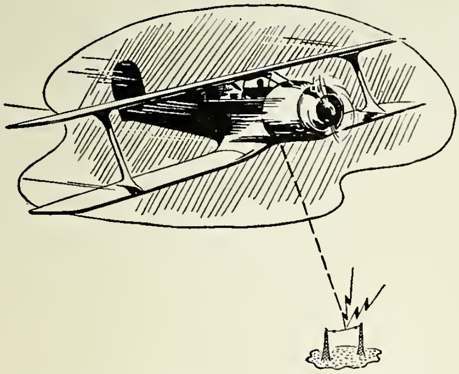
THE FISHER-COULTER

"RADIOPILOT"



The Fisher Coulter Radio Direction Finder, "THE RADIOPILOT," reduces the problem of navigation under any weather conditions to its simplest form. Providing for simultaneous aural and visual radio direction finding, without any switching operation, the Radiopilot operates on transmissions from all commercial broadcasting stations, radio beacons, Federal Airways radio stations, or on any radio emission within its frequency range, 195—400 kcs; and 550—1500 kcs. It enables a pilot, with no special training, to navigate by means of any radio station, independent of the Federal Airways System.

With an overall weight of less than 25 pounds the rugged Radiopilot, highly sensitive and selective, employs a power supply direct from a 12-volt airplane battery. The Radiopilot has been tested in over 2000 hours of actual flight and has proven itself accurate and reliable.

SIMULTANEOUS RECEPTION OF RADIO INTELLIGENCE AND DIRECTIONAL HOMING ON THE SAME TRANSMISSION WITHOUT SWITCHING OPERATIONS

POSITIVELY UNILATERAL

(Indicates whether ship is flying to or from a radio station)

INTERNAL COLLAPSIBLE LOOP

(Eliminates drag)

FULL REMOTE TUNING & VOLUME CONTROL

OVERALL WEIGHT LESS THAN 25 POUNDS

The Radiopilot is adaptable and available for service to Air Transport Lines, Commercial Operators and Private Pilots

Write for descriptive booklet

"Let RADIOPILOT Show You the Way Home."

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50 young men

will start the world's finest aviation courses

THIS JULY

FIFTY young men from all over the world will select the Boeing School and be approved for enrollment this July. These men will graduate with definite advantages over other young men who choose merely "a flying school."

Enrollment is restricted at Boeing. *Our standards require that each student receive individual attention from faculty members. We believe this to be the first essential in aviation training.* That's why we limit enrollment.

We want students who are likely to "go places" in this highly competitive industry. And make no mistake about *this:* Aviation offers real opportunities, yes; but as in any field where the reward is great, the aspirants are many.

Boeing School refuses to "guarantee" jobs to its graduates; we do not believe any school can honestly promise placements.

But this we *do* promise—if you can make good at Boeing, you will be better equipped than the average to earn your way to worthwhile jobs and promotion.

To those who can meet Boeing's requirements, we offer the highest type of technical training . . . under 18 instructors . . . with the finest shop, laboratory and flying equipment.

Boeing offers a wide, complete range of practical courses ranging from a nine-month ground course at a tuition cost of $600.

The Boeing Airline Pilot and Operations course of two years' duration offers the student the most complete flight and ground training any school can provide—tuition $5800—4015 hours of instruction . . . design and fabrication . . . metallurgy . . . meteorography . . . power plants . . . communications . . . airline operations, from organization and personnel to revenue and traffic. And flying in 9 different types of planes, from 165 h.p. trainers to a 1350 h.p. transport.

Write today for full information about Boeing School and its entrance requirements. Rates from $600 upwards; courses, from 9 months to 2 years, starting quarterly. Convenient payment plan. Mail coupon today.

BOEING SCHOOL OF AERONAUTICS

DIVISION OF UNITED AIR LINES

NEXT REGULAR ENROLLMENT JULY 1

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Gentlemen: I am interested in the courses indicated:

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☐ Transport Pilot
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*Name*__________ *Age*______
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THE AIR SERVICES

Stinson Reliant purchased by the Coast Guard for radio research work

Models Aid Students

ENLARGEMENT OF the Naval Operations course at the Air Corps Tactical School, Maxwell Field, Montgomery, Ala., this year was effected through the initiative of Lieut. Col. Herbert A. Dargue, assistant commandant and instructor in this subject. During the past, the course consisted only of lectures, but this year a more practical demonstration of naval tactics, both in the air and on the ground, has been developed under Col. Dargue's direction.

A room, approximately 40 × 75 ft. has been converted into a game room and the floor marked off in squares in scale to represent one nautical mile. Small models of the principal classes of surface vessels have been made so that fleet dispositions of all types may be laid out and moves made on the game board actually to simulate a naval battle. Airplanes have been introduced by cardboard cut-outs mounted on pins, which may be stuck in the linoleum floor at any point to represent a given situation.

Except for the planes, the entire set-up is to scale and, from a standing position, the student has a generally correct impression of what he might see from an altitude of 5000 to 10,000 feet.

Maj. McAllister At Rapid City

MAJOR CHARLES D. McAllister, post commander at Maxwell Field, Montgomery, Ala., was ordered by the War Department to Rapid City, S.D. for the National Geographic Society-Army Air Corps stratosphere flight, serving as transport pilot. He will fly supplies and other equipment to the flight base.

Olmstead Field Gets Lighting Aid

A REMOTE control system for the operation of the landing floodlights at Olmstead Field, Middletown, Pa., incorporates a feature whereby the operator of the system can put the proper bank of floodlights into operation while taking into account the wind direction. Inasmuch as the control switches are located in the telephone exchange, some distance from the field, the system is operated as required by the telephone operator, who, without some sort of wind indicator, would have no means of knowing which bank of lights to turn on.

The device consists of any ordinary windvane mounted above the building in which the remote control switches are located, and in the construction of which is incorporated a contact bearer with one contact segment for each bank of floodlights on the field. The vane operates a small brush which makes electrical contact with one of the contact segments at a time, so that the particular segment with which contact is being made at any particular time depends on the wind direction. The small brush is of such width that when it loses contact with one segment, it contacts the adjacent segment.

Each is connected through a 12-volt transformer to a signal light over the appropriate floodlight control switch, and the contact bearer oriented with respect to the cardinal points, so that the segment making contact when the wind is blowing in a given direction causes a bulb to be illuminated over the switch controlling the proper floodlight bank to be used for the given wind direction.

Service Orders Speed Employment

SOME 600 workmen have returned to the Curtiss Aeroplane & Motor Co. plant for the start of work on the $2,700,000 Navy order for 135 scout-observation planes. One ship will be delivered in July, 6 in August, 10 in September, and 12 a month thereafter.

The week of May 12 saw the last of the 23 flying boats in a $2,300,000 Navy order completed by the Consolidated Aircraft Corp. Preliminary work has been begun on 50 Army two-seater pursuit planes at the Consolidated plant, but actual construction on this order will be done in the company's new San Diego, Calif., factory. The moving-out process will be started in July and finished by the middle of August.

Army Planes On Good-Will Flight

NINE ARMY Air Corps planes made a seven-day good-will flight around Central America under the command of Lieut.-Col. L. H. Brereton.

Nineteen officers made the trip from Cristobal, C.Z., touching at Costa Rica, San Salvador and Nicaragua. The presidents of Salvador and Nicaragua fêted the men during their trip.

Sixty Graduate Tactical School

THE AIR Corps Tactical School, Maxwell Field, Montgomery, Ala, graduated sixty men, including two officers of the Turkish Army and one from the Mexican Army. Graduation exercises will be held June 4.

In addition, a ground officers' school course was conducted from May 23 to June 6 with officers attending from posts in the Fourth Corps Area.

The course consists of a series of lectures and illustrated problems on a variety of tactical subjects, including attack aviation, Air Force, logistics, chemical warfare, anti-aircraft, air intelligence, engineering and aircraft equipment, bombardment, pursuit, observation, aircraft inspection service, and meteorology.

Langley Weather Broadcast Service

A SYSTEM is in the process of installation at Langley Field, Va., whereby weather broadcasts, similar to that of Department of Commerce stations will be made by the Post Operations Office there. This service will be operated on the frequency of the Langley Field radio beacon during poor daylight weather, when night flights are cleared to or from the field, and upon request. This service will be available 24 hours per day.

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95 TO 200 H.P. IN LINE
INVERTED AIR COOLED
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FROM UO-1 TO SBU-1

O3U-3 Corsair being catapulted from the U. S. S. Arkansas • Official photograph U. S. Navy.

The U. S. S. Saratoga with her complement of Naval airplanes. Official photograph U. S. Navy.

AIRPLANES built by the Chance Vought Corporation have an active role in the annual maneuvers of the Fleet in the Pacific. For Vought Corsairs operate today from all aircraft carriers and practically every battleship and cruiser in the Navy. They are carrying on a tradition established in 1922 by the Vought UO-1, first successful service type to operate from the deck of a carrier — and first to operate from catapults.

Since the first of the Pratt & Whitney powered Corsairs broke several world's speed and altitude records and became a standard observation type of the Navy, there has been a long line of Corsair types. Latest, sleekest of these is the SBU-1 scout-bomber, 84 of which are now on order for Navy use. Like the SBU-1, each new Vought type has marked an improvement over its predecessors in keeping with the increasingly exacting requirements of naval operation. Each has been achieved through close cooperation between the Chance Vought technical staff and the Naval Bureau of Aeronautics in producing aircraft best suited for a wide variety of missions.

CHANCE VOUGHT CORPORATION

EAST HARTFORD, CONNECTICUT

E. E. Wilson, President C. J. McCarthy, Vice President

SUBSIDIARY OF UNITED AIRCRAFT CORPORATION

ACTIVITY AT THE SCHOOLS

Class-Room Space Expanded

ANOTHER CLASS-ROOM was added to the space occupied by the Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, when an unused room in the terminal building adjacent to the engineering school's drafting room was rebuilt for use as a lecture hall. The addition was made to afford engineering students increased class-room facilities.

Students Win Awards

WINNERS OF the sixth Annual Boeing Scholarship were announced by the Boeing School of Aeronautics. Charles G. Sperry, Berkeley, Calif., won first prize, a two-year Boeing airline pilot and operations course, and Richard O. Jacobs won the second award, an airline technical course and 25 hours of flying instruction. First alternate was Fred Chamberlin, Oregon State College, and second alternate, Wilbur Nelson, University of Michigan.

Junior scholarships were won by Joseph Schirtzinger, Riverside, Calif., and Vernon Prather, Yakima, Wash. Both will receive flying and ground courses.

The W. T. VanHorn Trophy for April-May was awarded to Joseph Ridgway of Philadelphia, a master mechanics student at the Rising Sun Aircraft School, Philadelphia. This award is given the student who maintains the highest average during a two-month period required to complete the Aviation Ground Course prior to receiving actual shop instruction.

Enrollments Continue

TWELVE NEW students were enrolled in the Curtiss-Wright Technical Institute of Aeronautics during the last thirty days according to Major C. C. Moseley, president of the institute which is housed at the Grand Central Air Terminal, Glendale, Calif. Nine students were graduated.

The Spring term enrollment of students at Parks Air College totals 205, an increase over the enrollment figure for the last Spring and Winter terms.

Personnel Changes

ARTHUR A. L. NOVOTNEY has been added to the faculty of the Curtiss-Wright Technical Institute of Aeronautics according to C. C. Moseley, president of the school. Novotney will instruct in the metal department. Additional recent improvements in the department include increasing instruction by 40 hours and the addition of several pieces of light equipment for handling and working of metal.

Raymond C. Crawford has been added to the staff of instructors at the Grand Central Flying School, Glendale, Calif., taking over the position left by C. Fredericks who was blind flying instructor.

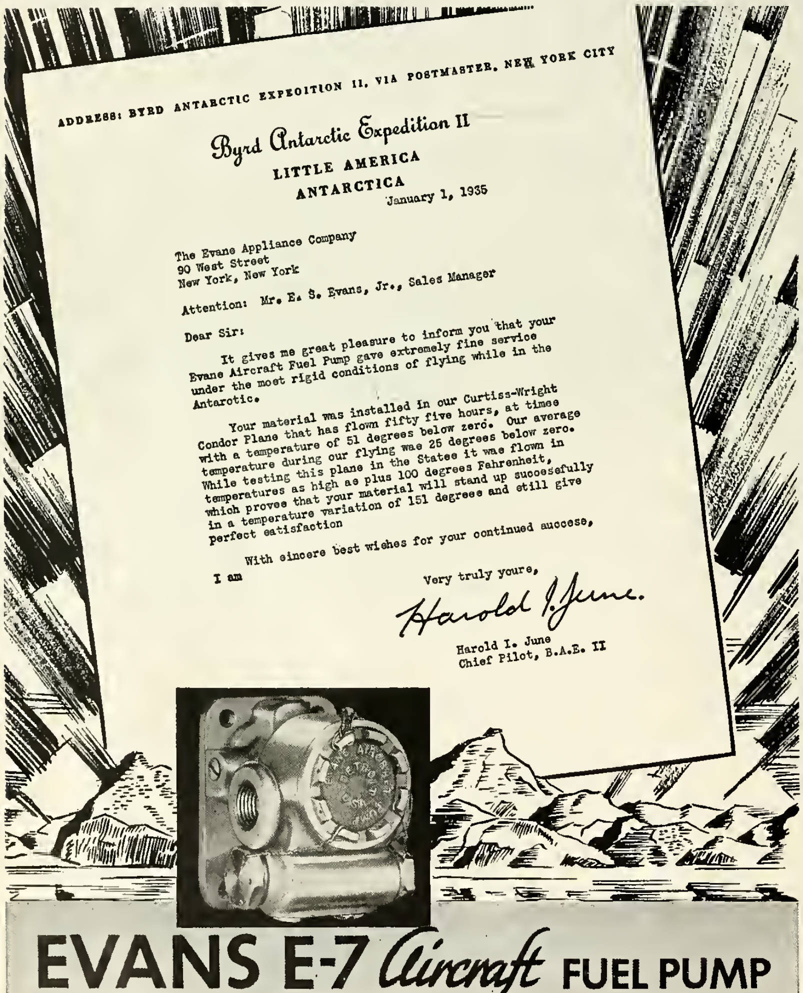
Appointment of the three chief pilots of United Air Lines—Walter Addems, Warren D. Williams, and H. T. Lewis—to an advisory board to supervise flight instruction methods at Boeing School of Aeronautics, Oakland, Calif., was made by President W. A. Patterson of United Air Lines, of which the school is a division.

School Approvals Issued

ONE FLYING school and four ground schools received official ratings recently.

The flying school approved is Commercial Aircraft Co., Inc., Portland, Airport, Swan Island, Portland, Ore., as an amateur and private, ground and flying school in conjunction with the Oregon Institute of Technology of the same city.

Airplane and Engine Mechanics School certificates were issued to the Aeronautical University, Inc., 1338 So. Michigan Ave., Chicago, Ill.; Casey Jones School of Aeronautics, Newark, N. J.; New England Aircraft School, Boston, Mass., and the Stewart Technical Trade School, New York, N. Y.



ADDRESS: BYRD ANTARCTIC EXPEDITION II, VIA POSTMASTER, NEW YORK CITY

Byrd Antarctic Expedition II
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ANTARCTICA

January 1, 1935

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Dear Sir:

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Your material was installed in our Curtiss-Wright Condor Plane that has flown fifty five hours, at times with a temperature of 51 degrees below zero. Our average temperature during our flying was 25 degrees below zero. While testing this plane in the States it was flown in temperatures as high as plus 100 degrees Fahrenheit, which proves that your material will stand up successfully in a temperature variation of 151 degrees and still give perfect satisfaction

With sincere best wishes for your continued success,

I am

Very truly yours,

Harold I. June

Harold I. June
Chief Pilot, B.A.E. II

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EVANS AIRCRAFT FUEL PUMPS assure a higher degree of continuous correct gas pressure on the carburetor regardless of air conditions, temperature, or flying position. With constant fuel pressure, motor efficiency is increased and an unvarying R.P.M. secured at all throttle positions. Evans Aircraft Fuel Pumps are endorsed by pilots and transportation companies everywhere. They are absolutely dependable.

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PRIVATE FLYING AND CLUB NEWS

Air Meets Scheduled

CARSON HINAMAN of Port Jervis, N. Y. plans to have an Aircraft Exhibition and Airport Dedication July 6 and 7 during which there will be a program of stunt flying, parachute jumping and other aerial activities. The affair is being run for the benefit of the Volunteer Firemen of Port Jervis.

A Fourth of July program will be given at the Lambert-St. Louis Airport under the auspices of the Airport Association. Racing, stunting and parachute jumping will be featured on the afternoon program and a night fireworks display is planned. D. D. Walker is directing the show.

The Third Annual Missouri Air Tour was scheduled to start in Kansas City and end in St. Joseph June 1. All of the principal cities in the state are on the itinerary of the three-day trip which was conceived to encourage aviation. It is under the direction of William Ong, Kansas City. Twenty-four planes flew in the tour last year.

The Tulsa Chamber of Commerce is sponsoring a program of air races the 29th and 30th of this month. The aviation committee of the Chamber is handling details with J. W. Welborn, John Carroll, Stanley Ehlinger, and J. M. Knappenberger in charge. The Tulsa Air Races will be held at the Municipal Airport in that city.

New Clubs Formed

REPORTS OF the organization of three new flying clubs indicates continuing interest in flying activities throughout the country.

Lodi, Calif., is the base for the Lodi Airmen's Club, formed to participate in Lodi's internationally famed yearly grape festival. Twenty-one members comprise the group which is headed by J. N. Lind who is also chairman of the Grape Festival aviation committee. The club meets twice a month at Lind's Airport.

K.I.O. Flying Club has been form
at Watson Airport, Cincinnati, and
sists of pilots from Kentucky, Ind
and Ohio. Officers are Albert La
president; Wade Jones, vice-presi
Milton Dold, second vice-presi
Floyd Siefferman, operations man
Walter Mussman, assistant secr
Melvin Wood, instructor; and Carl
assistant pilot.

Formation of a nation-wide civili
reserve organization moved a step
realization when the Civilian Air R
Corps merged with the Falcon Air
of America, so that jointly they spread the movement which proposes by means of large-scale operations, to provide a thorough training in aviation to those interested at a nominal cost.

A flying club is being organized at Notre Dame University, South Bend, and Max Conrad, founder and president of Conrad Flying Service of Winona, Minn., who is a student at the school, will direct its activities.

Brock Makes 2000th Flight

PRIVATE FLYING activities during the past month were featured by the 2000th consecutive flight of Dr. John D. Brock of Kansas City who completed his fifth year of flying every day in Washington, D. C. where he was congratulated by Eugene Vidal, Director of the Bureau of Air Commerce.

Out in California, Karena Shields recently obtained her private license and after accumulating more time under the instruction of Joe Plosser at Grand Central Flying School, she plans to commute back and forth between Central America and Los Angeles.

Thousands of pilots, mechanics, amateurs, manufacturers and home tool shop "tinkers" all over the country have already bought from me and know that they get a square deal. Hundreds more are being added to my list of customers and friends each month. Send your thin dime today for the Karl Ort Book of Bargains; start buying your accessories and equipment from the fastest-growing supply house in the country.

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AIRLINES AND AIR TRAVEL

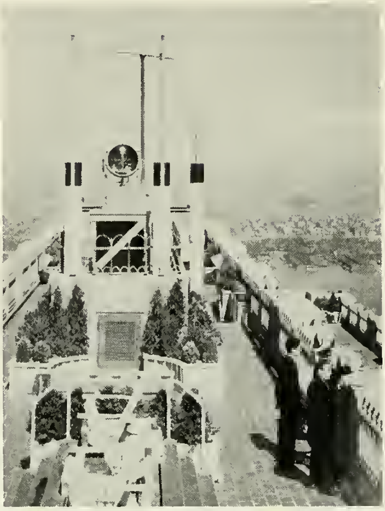
Schedule Revisions

NINETY-MINUTE service between Chicago and St. Louis was inaugurated recently by American Airlines permitting close connections with planes for Cleveland, Minneapolis and other cities. Planes leave St. Louis at 3 p.m. and arrive in Chicago at 4.29. Departure of the morning plane from St. Louis was changed to afford an immediate connection in Chicago for Cleveland and New York, and slight changes were made in the service from St. Louis to the southwest.

Later arrivals and departures of planes of Boston-Maine-Central Vermont Airways on the daily trips between Boston and points in New Hampshire, Vermont and Maine went into effect with the spring schedules for passenger, mail and express service. These changes provided "after business hours" departure from all points except Bangor and Burlington. According to General Passenger Agent J. V. Sheehan, service at the Montpelier-Barre, Vt. airport will not be resumed until the field is placed in proper condition.

Braniff Airways now provides a connection with TWA which offers faster service between Dallas and Los Angeles. Planes now leave Dallas at 4.05 p.m. and arrive in Los Angeles at 11.50 p.m. the same evening. The connection is made at Amarillo.

With a fleet of twin-engined Lockheed Electra transports, a score of additional pilots, mechanics and radio men, Northwest Airlines inaugurated on May 1, the first overnight schedule between Chicago and Seattle over the new northern transcontinental route. Four flights are made each day between Chicago and Seattle and six between Chicago and the Twin Cities. In addition, the new service provides first morning delivery of air mail on all points of the line between Chicago and Seattle which receive late afternoon departures. Daylight schedules previously in effect were revised so that a



Sperry beacon atop RCA Building, N. Y. C.

on a schedule of 3 hours 58 minutes. The first plane leaves Chicago at 4.30 p.m. and the second at 5 p.m. Arrivals in New York are, respectively, 9.28 p.m. and 9.58 p.m.

Schedule changes on United Air Lines last month featured addition of more round trips between New York and Chicago, and Los Angeles and San Francisco, increasing inter-city service between these points to nine round trips daily on each route and raising the company's total scheduled mileage to 1,350,000 monthly. Further expansion of service on the mid-continent coast-to-coast service and between Seattle and San Diego will be undertaken this month. A new Business Men's Special flight from Chicago to Kansas City was inaugurated during May.

Personnel Changes

TWO NEW directors, Niles Trammel and W. A. M. Burden, were added to

(Omaha), H. Anderson and T. Johnson (Chicago), John Baer, Gordon Logan, and Harmon Heald (Cleveland), and Pat O'Toole (Washington) to the traffic department.

Harold White, formerly station manager at Fort Worth, was appointed mail-express traffic manager for Braniff Airways and his former position filled by Peter Lenszler, who was transferred from Kansas City.

G. T. Weaver has been transferred to the Western division of Transcontinental & Western Air.

Four more stewardesses have been added to American Airlines' payroll for service on the Chicago-New York schedule, according to Earl F. Ward, general superintendent. They are Misses M. J. Barch, Tillie Dugas, Violet Wilson and Phylis Alldredge. The company now has a staff of forty stewardesses.

Airlines Set Mileage Record

SCHEDULED AIRLINES in the United States elevated the passenger miles flown figure to the highest level ever recorded by the Bureau of Air Commerce when they flew 24,134,055 passenger miles in March. This achievement is particularly noteworthy because March is normally a light air travel month.

The total number of passengers carried was 51,694, better than any of the previous two months this year.

Figures for March were compiled on the basis of reports from 20 of the 21 companies operating during that month; they flew 4,007,592 miles, carried 233,924 pounds of express and flew 154,470,802 express miles.

Ticket Offices Opened

INCREASING USE of air transportation, both for passengers and express, has necessitated opening new ticket offices in at least two cities.

A downtown ticket office was opened in Dallas by Braniff Airways, providing a central depot for the convenience of passengers, and Transcontinental & Western Air doubled its ticket office space in the lobby of the Palmer House, Chicago. P. B. Sturgis was transferred from Pittsburgh to assume charge of the enlarged ffice.

American Airlines leased a store room the Board of Trade Building, Chi-, for the convenience of air transport in the financial district. Lewis will be in charge.

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AVIATION ENGINE OIL
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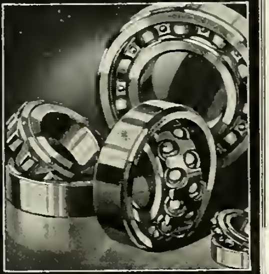
They're all "TIMEPIECES" but—there's a difference!

The Chronometer is a timepiece . . . but of such superlative and unvarying PRECISION that other timepieces are "set" by comparison with it as a standard. . . . . . . In other mechanisms, too, PRECISION marks the same degree of superiority—sets a standard of comparison . . . IN BALL, ROLLER & THRUST BEARINGS, FOR EXAMPLE.



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For new SPEEDS —new TUBING

From San Francisco to New York in 1896, the fastest bicyclers, riding in relays day and night, each with his pacemaker, took 13 days to carry a message across the continent. Now an airplane crosses in 13 hours. For such a development of speed, a marvelous adaptation of structure has been required

Aircraft tubing requires all that science and skill can put into such a product. Lightness, strength, uniformity, durability must all be present in extraordinary degree. In the manufacture of NATIONAL-SHELBY Seamless Aircraft Tubing, therefore, every resource of metallurgy, of engineering, and of manufacturing technique is employed. This tubing conforms to the highest standards, the most severe demands, for army, navy, or civilian use, and is specified by America's leading designers of aircraft. Inquiries will be given prompt attention.

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AT THE AIRPORTS

New Airports and Improvements

INSTEAD OF a private landing field on the north shore of the Columbia River, the city of The Dalles, Ore. now has a new municipal airport developed by the city with SERA funds.

A plan to shorten the run from the St. Louis-Lambert Airport to the city has been completed and it is proposed to widen Natural Bridge Road, the main artery from the city to the airport. In addition, the Municipal Airport Commission will undertake the installation of sunken lights in the field runways for which $3,800 has been appropriated.

When, and if, the Greater Buffalo Airport project materializes, the city of Buffalo, N. Y. will have a new administration building, plans for which have been completed.

A loan of $68,000 for construction of a hangar at the Little Rock, Ark., municipal airport has been approved by the PWA, and bids were to have been submitted last month.

Plans are now being made for an extensive construction program during the coming summer in Michigan. A total of 85 airport projects have been submitted to the State Planning Commission for consideration. Of this number approximately one half are new projects, and the remainder, improvements in existing fields.

The new Bend, Ore. airport was officially opened recently. The field replaces Knott Field on the Dalles-California airway and represents an investment of $15,000.

Newark, N. J. municipal airport dedicated its new administration building May 15 when Air Transport Day was celebrated there. It was the 17th anniversary of the opening of the air mail service. Costing $500,000, the new building was constructed with PWA labor, and is of brick, stone and marble construction.

Bids for a daily weather observatory flight in the vicinity of the Salt Lake City municipal airport will be opened July 1.

Airports Handle More Travelers

ALL RECORDS for air passenger traffic at the Cleveland municipal airport were broken in April when 12,523 persons arrived or departed in planes of the four lines serving the city. The daily average was 417. The previous record for a month's passenger business was in June, 1934 when 12,251 passengers were logged.

For the second successive month, air travel figures at Union Air Terminal, Los Angeles, broke all-time Southern California records in April. Averaging 160 revenue passengers in and out daily, the total was 4,788 or better by 771 passengers than the previous peak month.

New York Managers Organize

A STATE association of airport managers was organized at Buffalo, N. Y., when the directors of airports of New York State formed the New York State Airport Managers Association.

Robert Aldrich, director of the new municipal airport at Troy, was chosen president and secretary of the new organization, and Howard Shafer, manager at Rochester, was elected treasurer.

A Legislative Committee, composed of Nathaniel E. Duffy of Buffalo and Joseph F. Fitzgerald, Jr., of Albany, was named, and a Rates Committee, with R. I. Heath of Utica, was created.

All of the above are members of the Executive Board of the Association, with R. L. Kincaid, manager at Syracuse, as chairman.

The purpose of the association is the co-ordination of ideas, the dissemination of information, and the promotion of safety in aviation.

Personnel Changes

PAUL COX Field, Terre Haute, Ind., municipal airport is now being directed by John A. Kiefner under a recent appointment. Among the services offered are free transportation to the city and special hotel rates for pilots.

A new committee to handle airport affairs, created by the Columbus, Ohio, City Council, consists of Councilman Joseph R. Jones, chairman, Roger N. Addison and Melville D. Frank.

The parts department of Aircraft Industries, Inc., Grand Central Air Terminal distributor for Stinson aircraft is under the supervision of C. B. Quinn who replaced W. M. Clough who left to accept a position with Braniff Airways.

Planning to operate a short line between Niagara Falls and Buffalo, Frederick B. Downing, Jr., has been named manager of the Niagara Falls, N. Y. municipal airport and will operate the field under a lease from the city which will receive 10% of the gross revenue from field operations.

Charles O. Schick, for the past seven years connected with the Seattle, Wash., municipal airport weather bureau has been transferred to Salt Lake City to succeed C. R. Kallquist who has gone to Seattle to assume charge of the bureau there. Boeing Field also has a new airport superintendent in the person of Frank A. Yates.

Irving R. Kuehlhorn has been added to the staff of Associated Aviation Corp., operating from the Curtiss-Wright airport near Milwaukee.

CASEY JONES SCHOOL OF AERONAUTICS

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Courses in Master Mechanics and Aeronautical Engineering • Graduates are Qualified for Their Government Licenses
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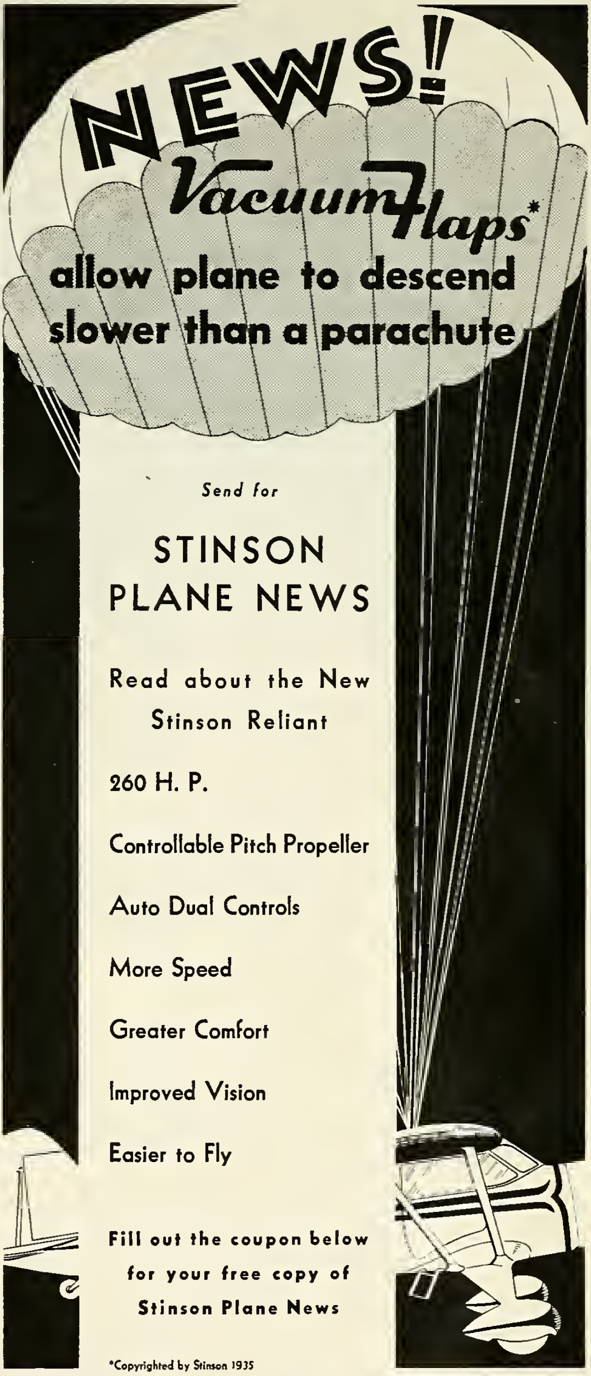

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THE INDUSTRY IN GENERAL

Bureau Extends Airplane Program

STILL STRIVING for the creation of a new low-cost, easy to operate plane for the private pilot, the Bureau of Air Commerce has contracted for a low-wing, all-metal two-place cabin monoplane to be built by the Curtiss-Wright Airplane Co., Robertson, Mo.

In appearance this plane resembles the generally used low-wing air transport plane, and there is a further similarity in the all-metal method of construction. According to J. H. Geisse, Chief of the Bureau's Development Section, this contract represents an investigation of the possibilities of metal construction, including stressed skin construction in designing for private owners.

A solid steel propeller of a new type will be built for the Bureau by Ernest G. McCauley, Dayton, who has a contract to supply five before September 30. These propellers will be thinner than types now used and will present, in cross-section, a different shape. Blades and hubs are to be machined from die forgings.

Casey Jones School of Aeronautics, Newark, will investigate for the Bureau the possibility of using a belt drive in an airplane from the engine to the propeller. The possible use of automobile engines in small craft has necessitated this investigation which will be directed to overcome the difficulty of converting these engines to aircraft use. One of the difficult and expensive modifications required is that of the necessary gearing to be interposed between the engine and the propeller. This gearing not only increases the weight of the engine but also may add almost 50 per cent to the cost of the engine.

Personnel Changes

OFFICERS OF the Boeing Airplane Co., Seattle, were recently reelected at the annual stockholders meeting. C. L. Egtvedt continues as president, while F. P. Laudan succeeds H. I. Kirk, resigned, on the directorate. Others reelected include Gardner W. Carr and J. P. Murray, vice-presidents, and H. E. Bowman, secretary-treasurer. Directors include in addition to the above, William M. Allen, Dietrich Schmitz, C. N. Monteith, Erik H. Nelson.

Professor William Frederick Durand, Professor Emeritus of Mechanical Engineering at Stamford University, was awarded the Daniel Guggenheim Medal for 1935 for notable achievement as pioneer in laboratory research and theory of aeronautics; distinguished contributions to the theory; and development of aircraft propellers.

T. Harold (Doc) Kinkaid joined the Gulf Refining Company's Aviation Sales Department as lubricating engineer and will work with Major Al Williams, the department manager. Doc will maintain headquarters in Pittsburgh and will visit airports and aircraft plants to iron out engine problems and make lubrication recommendations.

The Executive Committee of the Aeronautical Chamber of Commerce has appointed as a member of the legal and legislative committe for 1935, R. S. Pruitt, general counsel for Cord Corp., companies.

New Planes

WACO AIRCRAFT Co. has just announced its new 1935 Custom Cabin series four-place high-speed biplanes featuring refinements and improvements over previous models. Three engine choices are available to the purchaser from the Continental 210 h.p.; Jacobs 225 h.p., and Wright 250 h.p. Cruising speed varies, with the engine used, from 135 to 148 m.p.h.

Waco Custom Cabin has ample luggage space

Test flights recently were completed on the new Fuller-Hammond cabin plane, a two-place, twin Szekely-powered monoplane. It showed a maximum speed of 117 m.p.h., and a cruising speed of 100 miles per hour.

Consolidated to Have Three Buildings

WITH 225,000 square feet in its main building which will combine the factory and offices, the new San Diego, Calif., plant being built for Consolidated Aircraft Corp., now in Buffalo, N. Y. will contain three units in all, according to Ray P. Whitman, vice-president and assistant general manager.

Of the total floor area in the main building, 25,000 square feet will be devoted to the offices and engineering. The other buildings will include a mill, and a gate house which will house the employment, first aid and watchman.

The main building will measure 900 feet long. It will have a width of 300 feet on one side and 200 feet on the other, the front being divided into two 450-foot lengths with a 100-ft. wall connecting them. The mill will measure 50 × 100 feet with a floor area of 5000 square feet, and the gate house will measure 26 feet square.

Steel and glass construction, with concrete floors will be used. The front of the office portion of the main building will be stuccoed and finished; the roof will have a saw-tooth style with the teeth facing north. A railroad siding will be provided and the factory area will be fenced. The layout has been designed to provide for logical expansion in all departments.

The property on which the buildings are to be located is mostly a portion of Lindbergh Field and is approximately 33 acres in area. In connection with the project, the city of San Diego is building a marine ramp on the field which will be available for the company's usage.

At peak periods, the company will employ at least 1600 employees, most of whom will be hired on the West coast, inasmuch as only a skeleton force will be taken from Buffalo. With the receipt of additional government orders, especially from the Navy, the company will increase the number of workmen in excess of 1600. At present an Army Air Corps contract for single-engined two-place pursuit planes has been received.

(Continued on following page)

Szekely-powered Fuller-Hammond monoplane for two passengers

MR. ENGINEER YOU CAN INCREASE MY PAYLOAD WITH BERRYLOID ZINC CHROMATE PRIMER

Extensive weight tests prove the use of Berryloid Zinc Chromate Primer is increasing payloads up to 100 pounds per ship! This remarkable primer gives extra protection against corrosion — yet is infinitely lighter than old type primer coats. Give your plane longer life, added protection, and greater payload capacity with Berryloid Zinc Chromate Primer! Write for complete details. Simply address

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You will find a shop well equipped with up-to-date equipment and precise checking instruments—a shop with a carefully gathered reputation for accuracy in the manufacture of small lots of intricate parts for the Aircraft and Automotive industries.

THE
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THE LAIRD
SESQUIWING

YEAR in and year out, LAIRD airplanes have flown the country's airways, revealing to seasoned pilots new standards of maneuverability, warming the heart of the sportsman flier, winning the lion's share of speed competition, unobtrusively performing the duties of commercial carriers. «« Those who believe in the combination of LAIRD advanced design plus LAIRD superior workmanship have four distinct models to choose from, powered with a choice of engines ranging from 240 to 550 h.p. Refinement in detail and design add a complement of flying comfort and maneuverability which keep LAIRD 1935 models a long stride ahead of their class. All are custom built to most exacting requirements.

THE LAIRD STANDARDWING

Another LAIRD winner—no matter how you look at it. Three place. Powered with Wright J-6, 285 h.p. Does 150 m.p.h. wide open, cruises at 135 m.p.h., and lands at 45 m.p.h. Cruising range, 600 miles. Equipment includes metal prop, lights, RCA radio, brakes, starter.

THE LAIRD SPEEDWING

One of the snappiest—in performance and style—open cockpit planes in the air. Three-place. Powered with 300 h.p. Wright engine (or P & W Junior), 175 m.p.h. top, 155 m.p.h. cruising; 55 m.p.h. landing. Cruising range 550 miles. Equipment includes brakes, variable-pitch prop, lights, compass.

LAIRD airplanes are "Custom Built" for the sportsman pilot and commercial buyer whose chief interests are high efficiency and dependability rather than price. We invite such buyers to write for complete information.

E. M. LAIRD AIRPLANE COMPANY

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"THE THOROUGHBRED OF THE AIRWAYS"

(Continued from preceding page)

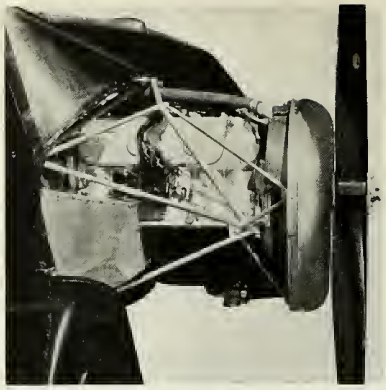
Berths In Martin Boat

THE CLIPPER flying boat constructed by Glenn L. Martin is now being soundproofed and will be a convertible sleeper plane when it resumes new tests. There will be lower and upper berths, which will be converted in daytime into seats. This ship and two sister ships are built for Pan-American Airways.

Planes Use 58,000,000 Gallons of Gas

AIRCRAFT IN the United States during 1934 used 58,414,256 gallons of fuel according to the Bureau of Air Commerce, Department of Commerce. Aircraft engines were lubricated by 2,158,288 gallons of oil.

Scheduled airlines consumed 25,136,274; miscellaneous civilian operators, 9,630,869; and government aircraft, 23,647,113 gallons of fuel. Oil was used as follows: scheduled airlines, 838,756 gallons; miscellaneous civilian operators, 348,985 gallons; government aircraft, 970,547 gallons. Government aircraft consisted of those operated by the Army, Navy, Coast Guard, and the Bureau of Air Commerce.



Installation details showing Plymouth engine in new Fahlin monoplane

Business Reports

NET PROFIT of United Aircraft Corp. for the quarter ended March 31, 1935, was $75,516.06, equivalent to $.03 per share on 2,087,532 shares of capital stock which will be outstanding when all exchanges of United Aircraft & Transport Corp. common stock have been made.

The Irving Air Chute Co. received an order for 400 parachutes from the U. S. Navy, according to George Waite, president, who reported business for 1935 exceeded 1934.

An increase in international passenger business and express volume last year enabled Pan American Airways Corp., to show a net profit of $1,064,471, or $1.68 per share against $898,000 or $1.42 a share in 1933, according to an annual report issued by Juan T. Trippe, president. Total revenues were $9,642,568 and expenses were $8,578,097.

(Continued on following page)

Digest of Recent Events

Jean Batten Sets Two Records

WHEN JEAN Batten landed at Croydon Airdrome to complete a round-trip flight from England to Australia she established one new record and broke another. She was the first woman to fly alone to Australia and back again and her outward flight took 14 days 23 hours 30 minutes, beating the woman's record of Amy Johnson Mollison, 19 days 12 hours.

APRIL 29

Amelia Earhart Flies Non-Stop Mexico City-New York

THE FIRST non-stop flight ever accomplished between Mexico City and New York, a distance of 2125 miles, was added to the growing list of Amelia Earhart's air accomplishments when she flew between the two points in 14 hours 18 minutes to establish a new record. Miss Earhart flew her Wasp-powered Lockheed Vega monoplane in which she flew across the Pacific and Atlantic oceans. The take-off was from Texcoco Airport and the landing made at Newark Airport. MAY 8

Transport Transcontinental Flight Record Made

COMMERCIAL PASSENGER plane flying time between New York City and Los Angeles was lowered by almost 30 minutes following a record-breaking flight of a TWA transport plane from Los Angeles to Floyd Bennett Field in 11 hours 5 minutes. Guided by a radio compass and relieved by a Sperry gyropilot, Pilot Tommy Tomlinson flew the Douglas plane only a small part of the time. He was accompanied by Peter Redpath, navigation engineer, and Harold Snead.

MAY 10

Glider Train Flies From Miami to Havana

TAKING OFF from Key West, Fla., a plane and two gliders flew to Havana in less than two hours to complete the first international glider train flight ever made. The gliders were piloted by Jack O'Meara and E. Paul du Pont, Jr., and Elwood Keim was at the controls of the towing plane. When over the Palace Parkway in Havana, the gliders were cut loose and landed on the parkway less than three minutes apart.

MAY 14

Stanavo Dolphin Sets Amphibion Record

THE FIRST record for amphibion planes flying a 100-kilometer course was established at Newark Airport when Major E. E. Aldrin, head of the aviation division of the Standard Oil Company, of New Jersey flew the company's new Douglas Dolphin at 159.8 miles an hour. This is the first time that such an attempt was made for record purposes. Major Aldrin was accompanied by Jimmy Taylor, who acted as an observer for the NAA. MAY 15

French Claim Two Speed Records In Air Race

COMPETITION FOR the annual Deutsch de la Meurthe Cup resulted in a claim for two new speed records when Raymond Delmotte, who won the 1242-mile event, averaged 443.965 kilometers an hour for two heats in the race, and Yves Lacombe did 469.36 kilometers an hour over the 100-kilometer stretch. The records established beat the late Helen Boucher's 409 kilometers an hour for 1000 kilometers, and Delmotte's 431.3 kilometers an hour for 100 kilometers. MAY 19

TWA Airliner Sets New Speed, Load Records

PILOTED BY Tommy Tomlinson, who was accompanied by Co-pilot Joe Bartles, a TWA transport plane, powered by two Wright Cyclone engines, flew a triangular course five times between Floyd Bennett Airport, Brooklyn, N. Y., Washington, D. C., and Willoughby Spit, Norfolk, Va., a distance of 621 miles each way for a total of 3105 miles (5000 kilometers). When the non-stop flight was completed, five new world's records and 9 American records for speed with loads were established. The flight was completed in 18 hours 22 minutes 49 seconds with an average speed of 169.03 miles an hour, far above the only other previous record for such a distance. This feat was accomplished on May 17.

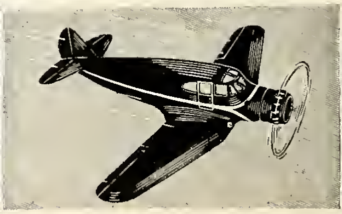
A few days later, the same plane and crew set three new world's records for speed with load for land planes and 2 new American records. This time the plane carried a load of 4,408 pounds and flew 1244 miles averaging 190.0 miles an hour for the two laps of the course. MAY 19

Spaniard Flies Solo Across South Atlantic

JUAN IGNACIO Pombo, 21 years old, flew from Africa across the south Atlantic to Natal, Brazil in 16 hours 55 minutes to become the youngest aviator to accomplish the feat. Pombo is enroute to Mexico, which he plans to reach in easy stages from South America. MAY 21

Dana Flies Across Country In Ryan S-T

SETTING A new elapsed time record of 33 hours 46 minutes, Peter Dana, 19-year-old Holderness, N. H., transport pilot, brought his Ryan S-T monoplane powered by a 125 h.p. Menasco in-line engine into Roosevelt Field, N. Y., 3 days 3 hours 2 minutes ahead of the former junior transcontinental time. Dana, however, failed by a few hours to establish a new flying time record, being hindered by fog and adverse weather. MAY 23



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Mr. B. P. Parrish, Jr., of the Parrish Flying Service and manager of the Columbia Airport, Columbia, South Carolina, bought 3 CUBS the first of the year. They were immediately popular . . . so much so that he had to order more. On May 10th Parrish took delivery of 2 more CUBS—making 5 now in use at Columbia Airport.

Whether you are a private pilot or a commercial pilot, investigate the CUB—its economy is what you have been hoping for.

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"Where can we buy . . . "

The directory of the aviation industry's sources of supply of raw materials and fabricated parts—which will be featured in the July "DIGEST OF AIRCRAFT & ENGINE MATERIALS"—will be a great time-saver for the aircraft and engine manufacturers' purchasing agents and engineers.

Every aircraft, engine and accessory manufacturer should have several copies handy in his various departments—where they can be consulted conveniently and where they will not be torn or "lifted."

Orders for extra copies of the "DIGEST OF AIRCRAFT & ENGINE MATERIALS" should be placed before June twentieth.

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AND
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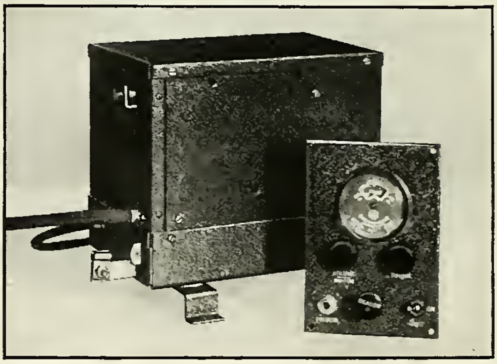

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Here are unquestionably the smallest, lightest and least expensive complete receivers of proven merit ever offered for aircraft use. But despite their size and weight they are wonderful performers. At the price of $119.50, they are the most remarkable values in aviation radio equipment.

RCA offers you two of these lightweight receivers. AVR-7 gives you the beacon and entertainment bands, AVR-7A the beacon and communication bands. Both are 4-tube superheterodynes, highly sensitive, in strong metal cases, including built-in power supply operating from the battery on your ship. There are only two units: the receiver and the remote control unit. Since only four screws are required to mount each unit, installation is exceedingly simple.

These receivers are supplied complete with tubes, cables and high-grade phones. There is nothing else to buy.

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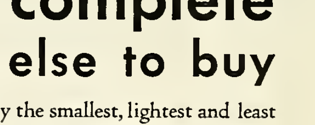
You'll find a warm welcome at RCA's new Aviation Radio Headquarters at Central Airport, Camden, N. J. Your ship will be taken care of while you inspect the RCA line. Airline and airport operators will be especially interested in the new RCA ground equipment, both transmitters and receivers.



AVIATION RADIO SECTION
RCA MANUFACTURING CO., INC.
Camden New Jersey

(*Continued from preceding page*)

March Exports $1.735.542

A PICK-UP in sales of American aeronautical equipment abroad in March brought the value for the first three months of 1935 to $4,265,037. March business in foreign countries amounted to $1,735,037 with 51 aircraft valued at $1,104,460, and 54 engines valued at $131,501 making up the bulk. Sales of parts and accessories amounted to $499,172, and of parachutes, $409.

Chinese purchases accounted for 28 planes, 5 engines and $54,971 worth of accessories, the entire sales coming to $468,108. Sweden bought 4 engines valued at $30,870, while Canada was close behind with $30,498 for 22 engines. Russia spent $113,392 for parts and accessories and $9,894 for one engine. Mexico was well up among our leading customers spending $230,000 for 3 planes, $5,170 for 5 engines, and $3,447 for parts. Other countries in which aircraft were sold included Chile (5), Brazil (3), and France, Netherlands, Spain, Great Britain, Canada, Guatemala, Honduras, Argentina, Colombia, Peru, Japan and the Union of South Africa (one each).

Pilot Tomlinson in the record-making Douglas

COMING EVENTS

A Regional Airport Conference under the auspices of the Aeronautical Chamber of Commerce will be held in Boston, Mass., June 12-13

•

The Second Annual Good-Will Tour of the Wisconsin Veterans of Foreign Wars will visit 42 cities. June 16-22

•

National Intercollegiate Air Meet will be held at Purdue University Airport, Lafayette, Ind. June 22

•

A Regional Airport Conference under the auspices of the Aeronautical Chamber of Commerce will be held in Detroit, Mich., July 2-4

•

Aviation Day, a feature of the Connecticut Tercentenary celebration, will be held at South Meriden, Conn., under the supervision of the local American Legion Post. July 5

•

An air program will be given at the Lambert-St. Louis Airport under the auspices of the Airport Association featuring races, stunting, and parachute jumps. July 4

•

Aircraft Exhibit and Airport Dedication, Port Jervis, N. Y., will be held under the auspices of the Volunteer Firemen of Port Jervis with Carson Hinaman in charge. July 6-7

•

The Sixth Annual National Soaring Contest will be held at Elmira, N. Y. June 29-July 14

•

The Western Canada Air Races and Air Show will be held in Vancouver, B. C., under the auspices of the Junior Chamber of Civic Affairs. July 20

•

A class C Aircraft Show will be held at the Detroit City Airport, Detroit, Mich., under the direction of Ray Cooper. July 20-28

•

International Aerial Competition will be held under the auspices of the Royal Aero Club of Italy at Rome. There will be a tour and an aerial competition held in conjunction with the event. August 24-30

•

America's Schools of Aviation Day at the California Pacific International Exposition, San Diego, Calif., will feature a complete aviation program. August 25

Douglas Sets New Records

SIX WORLD records were broken, two set, three American records broken and eight set by the Douglas transport DC-1 flown by Tommy Tomlinson and his co-pilot Joe Bartles during their assault upon speed and load-carrying records held outside of this country. One flight was made May 17, and another on May 19. On both days records were broken or established.

These records follow:

World records broken: 1000 kilometers with 1000 kilogram and 2000 kilogram load; 191.674 m.p.h.; 2000 kilometers with 500 kilograms, 190.906 m.p.h.; 2000 kilometers, 1000 kilograms, 190.906 m.p.h.; 5000 kilometers, without load, 160.03 m.p.h.

World records set: 5000 kilometers with 500 and 1000 kilogram loads, 169.03 m.p.h.

American records broken: 1000 kilometers with no load and with 1000 kilogram load, 191.674 m.p.h.; 2000 kilometers without load, 190.906 m.p.h.

American records set: 1000 kilometers with 500 and 2000 kilogram loads, 191.674 m.p.h.; 2000 kilometers with 500, 1000, and 2000 kilograms, 190.906 m.p.h.; 5000 kilometers without load, 500 and 1000 kilograms, 169.03 m.p.h.

The flight on May 17 was made over a triangular course between Floyd Bennett Field, Washington, and Willoughby Spit at an average altitude of 10,000 feet, necessitating the use of theodilites to check the plane as it passed overhead. Constant communication was maintained at all times with the pilots by the ground stations, and when weather conditions in the south changed, they were instructed to alter their course to follow a triangular path between the Brooklyn field, North Beach Airport, and Newark Airport. At the end of the flight, the two men seemed unaffected by their long hop.

Improve Radio System For New Route

TRANSMITTERS AND antenna tuning systems for installation along the Northern Transcontinental Airway between Seattle and the Twin Cities are being made by the Chicopee Falls, Mass., Radio Division of the Westinghouse Electric & Mfg. Co. The equipment is of the most modern type and embodies the results of the research and field work of both the Westinghouse company and the Air Navigation Division of the Bureau of Air Commerce.

(*Continued on following page*)

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(*Continued from preceding page*)

1,859,031 Passengers Flew in 1934

MORE PEOPLE flew in 1934 than during the previous year according to the Bureau of Air Commerce which reported that civil airplanes in the United States carried 1,859,031 passengers in 1934 compared with 1,739,275 in 1933.

Of this number 461,743 flew on domestic scheduled airlines, and the balance with miscellaneous commercial operators and private owners. These miscellaneous operators carried 825,595 persons during the last half of the year, during which they logged 38,821,995 miles. The figures for the last six months of 1934 constituted the best record for this category since the same period in 1931.

Greater safety also was evidenced in these reports. While the miscellaneous operators flew 377,200 miles per fatal accident in 1933, for 1934 this figure was increased to 392,141 miles for the last six months of the year. For every accident that occurred, including both fatal and non-fatal, the miscellaneous operators flew 45,406 miles during the period being considered. This was almost the same as the corresponding figure for the last half of 1933 when these operators flew 45,912 miles per accident.

Aircraft Sales

SELLING ACTIVITY continues at a good pace as reports from various sections of the country show numerous deals closed for new aircraft.

Roger Wolfe Kahn ordered from Dick Depew and Beckwith Havens of Roosevelt Field, a new Fairchild "24" powered with the 145 h.p. Ranger engine.

Four new Waco custom cabin planes are being flown on the West Coast by H. C. Lippiatt, Paul Granger, Henry King, and Leslie P. Bowman, Waco's factory coast representative. The Bowman and Lippiatt planes are being stored at Union Air Terminal, Los Angeles.

Lou Foote Flying Service, Dallas distributor for the Taylor *Cub* airplane reports the sale of five of these planes, and their own acquisition of a new plane for demonstration purposes. J. M. Rush, who hangars his plane with the Foote company, purchased a new Wright J-6 powered Beechcraft from the factory.

Boeing Airplane Co., and United Air Lines sold four single-engined Boeing 40-H4's to New Zealand Airways, a tri-motored Boeing 80-A to Cia Nacional Aviacion Guatemala and a Boeing 40-B4 to the same company.

The St. Louis Flying Service, Lambert-St. Louis Airport, recently sold its tenth Fairchild since taking over the distributorship for these planes last year. Glen Pyle, Terre Haute, Ind., was the purchaser of the plane, a Fairchild "24."

Recent sales of aircraft engines for export purposes reported by Charles Babb, Grand Central Air Terminal, Glendale, Calif., include a Wright J-6-9, Lycoming, a new J-5, a Wasp, and a large order of engines and parts to Epalazio and Company, of Nicaragua. A Stearman was sold to Don Best, Woodland, Calif.; Great Lakes to Leonard R. Peterson Co., Seattle, Wash.; Waco F to Rust and Murdock, San Diego, and a new Wright-powered Waco cabin to Burr Bush, Denver, Colo.

New Dealers

UNITED AERO CORP., San Antonio, Tex., have taken over the distributorship of Aeronca planes in South Texas. The company is headed by Al H. Tuerpe, president; Marlin Fischer, vice-president; and Carl Wallrath, secretary-treasurer.

Truman Wadlow, recently appointed direct factory representative for Beech Aircraft Corp., in Southern California is now located at Union Air Terminal, Burbank, Calif.

Fairchild Builds Factory Addition

INCREASING BUSINESS has necessitated a 70 percent expansion in the size of the Fairchild Aircraft factory at Hagerstown, Md., according to Sherman M. Fairchild, president of the Fairchild Aviation Corp.

A new wing which will make 29,000 square feet more available, is well under way and it is expected it will be completed about July 1. The total floor space available will be 70,000 square feet.

The increasing demand this year for business and pleasure airplanes is shown by the fact that the sales of Fairchild private craft increased 40 percent from 15 in the first quarter of 1934 to 21 in the first three months of this year.

Cabin arrangement of the Fairchild "24"

Kollsman Opens Glendale Branch

KOLLSMAN INSTRUMENT Co., have established a branch office at Grand Central Air Terminal, Glendale, Calif., with Charles H. Crockett, formerly service engineer for Kollsman, in Brooklyn New York, as manager.

A. Biederman will continue handling service for Kollsman in the west by operating the service department of the new branch. His shops are being revised and improved. Engineering facilities and the necessary equipment for calibrating, repairing and assembling instruments are being installed. He will also maintain a service department for outside field service work. A complete stock of instruments and parts will be carried.

Giro Demonstration Completed

AN EXTENSIVE demonstration trip of the new wingless direct-control Autogiro has just been completed by Lou Levy, test pilot for the Kellett Autogiro Corp., who visited Harrisburg, Pittsburgh, Columbus, Dayton, Washington, Baltimore and Langley Field.

Approximately 300 demonstration flights were made and more than 100 military and civil officials flew in the KD-1.

Despite unfavorable weather conditions at times, the new Giro did not miss a single scheduled demonstration flight.

Bunch Buys Lambert Control

CONTROL OF the Lambert Aircraft Corp., and subsidiaries passed to Clare Bunch and associates when they purchased the interest of J. D. Wooster Lambert. The former was elected president succeeding Mr. Lambert. B. L. Carter was named vice-president and E. E. Freel, secretary-treasurer.

The Lambert Corp. will operate under its present name, and will continue to devote its facilities exclusively to the development and construction of the private airplane. Lambert also will build its own engines at the Lambert Engine & Machine Co., Moline, Ill., a subsidiary.

Lambert engineers have completed a test program to improve the temperature operating conditions of the engine and the cowling on the Lambert 90A DeLuxe.

Industry Produces 349 Airplanes

THE AMERICAN aircraft industry produced 349 airplanes in the first three months of 1935, according to the Bureau of Air Commerce, an increase of 90 over the similar period of 1934.

Airplanes produced in the first quarter of 1935 included 193 for domestic civil use, 84 for military purposes and 72 for export. In the first three months of 1935, as compared with the corresponding quarter of 1934, there was an increase of about 100 percent in production for domestic civil use, a decrease of some 25 percent in military deliveries and an increase of approximately 50 percent in aircraft manufactured for export.

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Major "Al" Williams, Lecturer and advanced flying Instructor.

Hugh Copeland, Transport Pilot and Chief Ground and Mechanics Instructor.

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RECENTLY an old timer in the aircraft game visited our Home office and looked over the stock. Here's what he said:

> "Here I am looking at this stock with my own eyes and still can hardly believe it. I have seen all the other aeronautical stockrooms in the country and, after seeing this one, I know beyond doubt who the world's largest supply house is; regardless of claims made by others whose stocks are mediocre compared to this one."

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FOREIGN NEWS IN BRIEF

Australasia

PROPOSALS FOR safeguarding commercial Australian air routes will shortly form the subject of a report to the Federal Cabinet. The Federal Ministry contemplates further use of radio on the commercial air routes and a postal engineer of the Postal Department is leaving for Britain and America to study radio equipment on the air routes in those countries.

The Ministry desires to provide two major services for the main air routes; the first will be an effective frequent transmission of weather reports and storm warnings to planes in flight. The second is the installation of a comprehensive network of radio services for navigation purposes.

KINGSFORD SMITH Air Services has merged with Eastern Air Transport, resulting in the development of present air services conducted by the two companies. It is hoped to start additional passenger and mail services in the near future.

AERIAL PHOTOGRAPHY in the geophysical survey of North Australia will be undertaken by R.A.A.F. personnel and equipment. Bids from private aircraft operators were invited, but they were too high. The cost of the work by the military machines would only be about one-seventh of that of the lowest bid received. The difference is due to the Air Board accepting the undertaking as providing valuable training for the Air Force personnel.

CARGO CARRIED by aircraft engaged on the goldfields services in New Guinea showed another advance last year. The annual report of the Civil Aviation Branch of the Australian Department of Defence states that freight carried by air amounted to 7,679 tons, an increase of 27 per cent over 1933.

The airplane is the only practical vehicle between the New Guinea coast and the interior. On the surface, the journey takes many days, because of mountains, almost impassable jungle, and rivers. The plane covers the distance in from thirty minutes to an hour, including a climb to 8000 ft. to clear the mountains.

A COMMERCIAL airport at Nagoya has opened for use by planes in scheduled services. The airport is 4 miles from the city and the landing area measures 555 feet east and west by 755 feet north and south. An area of 330,000 square feet is to be reclaimed, the northern end is to be dredged for use by seaplanes, and there is a hangar, gliding stands, signal posts, and fuel and oil tanks.

THE QANTAS airliner *Brisbane,* flying from Darwin to Koepang, recently covered the 518 miles across the Timor Sea in 2 hours 50 minutes, a new record.

A PORTION of the £15,000 appropriated for improvement of the Mascot aerodrome has already been spent, but construction of a control station, for which £2500 has been set aside, will be delayed pending a report from Capt. Johnston, Controller of Civil Aviation, who is investigating methods in other countries.

Canada

CANADA'S PARTICIPATION in an extension of the air mail service between London and various parts of the Empire was the subject of a recent conference between Canadian government officials and Brig.-General Sir Frederick Williamson, director of postal services at the General Post Office in London, and Sir Edward Campbell, Parliamentary Private Secretary to the Postmaster General.

Under the project now being discussed with the various Dominions, it is proposed to eliminate the special surcharge air mail service to the Antipodes by the existing routes. The difference will be, if and when the cooperation of the Dominions is secured, that the service will be at higher speed and greater frequency. It is planned to send two mails a week from Britain to South Africa and to Australia, three mails a week to East Africa and the Straits Settlements, and four or five a week to India. It is hoped to land the mail at Sydney, Australia, from London within seven days of departure, in New Zealand within eight days, and in India within four days from London. The present service by steamer from London to Sydney is 33 days.

Canada will gain the advantage of a week in mail transmission to these parts of the Empire, both going and coming, by getting the mail at London from the Antipodes, South Africa and India much earlier. The same advantage applies to mail sent from Canada to London and then forwarded by the faster air service. The present time between Vancouver and the Antipodes is about three weeks, while by London and the proposed air service it would be only two weeks (one week by boat between Canada and Britain and one week by air between Britain and the Antipodes).

CONCLUDING A winter passenger, mail and freight service along the North Shore of the St. Lawrence which opened on December 22 and closed April 15, officials of Canadian Airways, Ltd., and

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Grand Central Airport
Complete catalog of aviation supplies, parts and materials will be sent on request.

Quebec Airways, Ltd., reported that 73,481 pounds of mail were carried, 26,740 pounds of express, 795 passengers, and 594 hours flown.

LIEUT.-COL. WILLIAM A. Bishop, V. C., vice-president of McColl-Frontenac Oil Co., Ltd., has been unanimously nominated honorary wing commander of Montreal's English speaking squadron of the Royal Canadian Air Force, according to Squadron Commander Frank McGill. Formal approval of the appointment comes from the Minister of National Defence.

THIRTY TRAINING ships were recently shipped from the Fort Erie, Ontario, plant of the Fleet Aircraft Co., of Canada, to the Chinese National Government's training school at Hangchow. The ships are two seaters, powered by 125 horsepower Kinner engines, and are similar to training ships supplied by this company to Camp Borden, Royal Canadian Air Force training field.

A NEW plane is to be purchased by the Toronto Flying Club. According to the agreement with the government, this means that the government would supply one ship free to the club, in addition to the purchase. Flying time to date is three times as great this year as last, and 23 student members are receiving instruction.

C. H. CLENDENNIN, director of the Irish Transatlantic Corp., reported his company hopes to start within a year an air mail service between Galway and Notre Dame Bay, Newfoundland. He said the service would be flown with seaplanes and that the flying time between the two points was expected to be 8 hours 35 minutes under ordinary conditions.

THE 1934 financial statement of Canadian Airways, Ltd., presented to shareholders at their annual general meeting, showed improvement in operating revenues, together with an increase in working capital. The results of the past year's operations, stated President James Richardson, were the most satisfactory since 1930.

Operating revenues amounted to $881,536, as compared with $615,466 in 1933. After deduction of operating expenses at $837,867, there were operating earnings of $43,668, as compared with an operating deficit in 1933 of $226,318. The balance sheet shows current assets of $397,657, and current liabilities of $55,800. A year ago, working capital was $310,557. Cash account is higher at $54,772, but investment in Dominion Government bonds has fallen from $150,000 to $75,000.

THE FIRST Annual Western Canada Air Show and Races will be held at the Vancouver Airport on July 20 under the sponsorship of the Junior Chamber of Civic Affairs. Many manufacturers of aircraft in the United States and Canada are planning to have planes at this Meet, and many private pilots are also arranging to attend. One of the highlights will be a race from Seattle to Vancouver.

France

AIR FRANCE has just finished its seventh year of operation in Chile. In this connection a report from Paris advises that it now receives the following from the French government; $14,143 for each ocean flight or a maximum of $1,470,760 annually, plus $2,942 annually for the next two years for services in South America. In addition, it obtains planes from the government for its services. The maximum total which the government has fixed for all lines of Air France is $10,023,477 for this year and $9,822,021 for 1936. The weekly air mail service between Chile and Europe is still being maintained.

AIRCRAFT FACTORIES in France are busy turning out new models. Construction of the multi-place Marcel Bloch 200 is continuing regularly, and the factories of the Potez-Bloch group are building planes at the rate of 25 a month. The 30 Bloch 200 planes of the first series were delivered in one year, 26 of which were made at the factory at Meaulte and 4 at Courbevoie. The second series consists of 30 planes and the third of 60, of which 38 are to be built at the Loire factories and the Breguet factory at Saint Nazaire.

The Potez 56, a 6-passenger twin-engined plane, has just been completed and approved. This plane has a retractable landing gear and is constructed of wood. It is expected to fly the interior services, having an estimated top speed of 149 m.p.h. and 109 m.p.h. with one engine dead. Orders for 15 have been received since its presentation at the 1934 Aeronautical Salon. Potez also expects to bring out a twin-engined transport powered with Gnome-Rhone K-14 engines, built along the lines of the Potez 54. It will carry 14 passengers.

The new Breguet 413 plane, powered by two 860 h.p. engines, has completed several test flights. The Breguet 414 has also completed its official tests at which it obtained a top speed of 194 m.p.h. at 13,123 ft., and climbed to 19,685 ft. in 17 minutes. The seaplanes ordered by Air France and now at Marignane, are tri-engined planes of the Saigon type and are beginning their 100-hour test flights before being accepted.

Loire and Olivier has just begun construction of pursuit planes for Lithuania. They will be equipped with 4 machine guns placed in the wings; 2 other guns can be installed to fire through the propeller.

Great Britain

AT THE Hamble Air University there is increasing activity each month. During March, 707 hours of instructional flying were logged, making a total for the first quarter of 1788 hours. The school fleet now consists of 31 planes. Pupils who entered for the commercial course last September have completed their first six months of practical training in the workshops and started flying instruction.

RESEARCH ON aerodynamical problems will be conducted in the new full-scale wind tunnel which began working in April at the Royal Aircraft Establishment, Farnborough. In effective diameter the working airflow between the mouths of the tunnel measures 24 feet, sufficient to accommodate the fuselage, center section and propeller of planes of up to 56 feet in wing span and 8,000 lbs. in weight.

The tunnel is housed in a steel and ferro-concrete building, together with two cranes for hoisting aircraft into position, a lift, two overhead cars, a balance room, and the 2,000 h.p. motor. It consists essentially of a tube, more than 400 ft. long, bent around on itself to make a circuit, and cut away for a distance of approximately 45 ft., thus constituting the open jet of air in which the plane is mounted before the wooden fan, which

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revolves at speeds up to 250 r.p.m. The fan has a clearance of only four-tenths of an inch between its tips and the tunnel wall.

COMPONENTS ARE taking shape in the Short factory of the composite aircraft designed by Major R. H. Mayo to increase the range and load capacity of aircraft. Supported by a subsidy from Air Ministry funds, Imperial Airways has ordered the first machine which will be used in test work, including experimental flights with mail across the North Atlantic Ocean.

Essentially, the composite plane provides a means of launching an airplane which is so heavily loaded that it could not take off under its own power. A large carrying machine supports the heavily laden craft on its wings. A patented device locks the two together and permits use of the full engine power of both for the take-off run. When the required altitude is reached and the combined craft are travelling at sufficient forward speed, the upper plane parts company from its bearer and continues the flight alone.

Launching speed may be in excess of 100 m.p.h. Stalling speed of the fully laden launched machine, therefore, may also be well above 100 m.p.h. In effect, the launched plane starts its journey with a much larger load on board than it could safely lift unaided. At the end of its flight, fuel consumption and the loss of disposable load will reduce the load sufficiently to allow a normal landing.

Calculations show that the operational range of a seaplane should be doubled, and that of a landplane trebled. The units now building will be made up of two four-engined monoplanes, one of them (the porter) a flying boat, and the other a seaplane.

AN AIRPLANE for $1,375 is the latest British development to popularize flying. The plane, soon to be placed on the market, is known as the Drone, and in addition to being cheap, features low maintenance and running costs. In its present form it is a single-seat monoplane, powered with a 16 horsepower motorcycle engine. It cruises at fifty m.p.h., but does that fifty miles on one gallon of fuel.

FAST LONDON-PARIS service will be introduced early this summer. The London terminal will be at Gatwick, from where passengers will be carried by rail to Victoria Station. The elapsed time from that station to the Place de la Concorde, Paris, will be 2 hours 20 minutes, the flight requiring one hour. London and Continental Air Lines which will operate the service is supported by Airports, Ltd., and plans to use American low-wing, twin-engined, planes.

Italy

MODELS FOR a new Milan airport are being exhibited at the Castello Sforzesco. This airport will be modern in design and built in the form of an *L* at the end of the Viale Michele Bianchi. It will have necessary passenger conveniences such as restaurant, large waiting room, taxi service, custom offices, etc.

THE ROYAL Aero Club of Italy has sponsored an international competition called Raduno del Littorio, which will be held from August 24 to August 30. This competition, reserved to private planes of all categories, is intended to revive the Italy Aerial Tour, which has not taken place since 1931.

The competition includes an air rally in Rome (August 24 and 25) and a circuit (August 27 to 30) with start and finish in Rome. The circuit will be flown over a course between Rome - Littoria - Sessa - Naples - Bari - Pescara - Loreto - Falconara (Ancona) - Rimini - Ferrara - Mantova - Milan - Venezia - Bologna - Montecatini and Pisa.

Japan

PLANS FOR establishing air service between Tokio, Hsinking, Osaka and Java by Kokusaku Kenkyu Kai have reached a more advanced stage. The organization is convinced of the possibility of a regular service, provided it can obtain a yearly subsidy of $424,000. It is intended to form a joint Japanese-Manchukuo company (the Japanese-Manchukuo Aeronautical Joint Co.), with a capital of $4,240,000.

The Tokio-Java service will be operated fortnightly, and the Tokio-Hsinking weekly. The principal airport will be at Mohara in the prefecture of China. It is possible that a second class fare will be introduced. The first class fare for Tokio-Hsinking, (a distance of 1,367 miles which will be covered in 16 or 17 hours), will be $42.45 and the second class fare $16.98. The first class fare to Java will probably be $141.50.

Mexico

COMPANIA DE Transportes Aereos de Chiapas, S. A., has been granted a concession to operate passenger, mail and express service between Tapachula, San Cristobal de las Casas and Comitan, Chiapas; passenger, mail and express service has been started on a four times weekly basis between Oaxaca City, Ometepec, Pinotepa, Tutepec, Pochtla and Acapulco by Compania de Transportes Aereos del Pacifico, in addition to a special sight seeing service between Oaxaca City and the Huxpaltepec archaeological zone; and two tri-weekly passenger and mail services have been started out of Mexico City by Charles C. Baughan. One route is to Villa Azueta, Vera Cruz, with a stop at Orizaba, and the other is to Oaxaca City, with a stop at Tehuacan, Puebla. Baughan proposes to conduct a local service between Orizaba and Jalapa, the Vera Cruz capital. Semi-weekly passenger service has been established between Huatusco and Cordoba, Vera Cruz.

South America

THE BRAZILIAN Naval Aviation Service has signed a contract for 14 American planes which are to be used for cross-country training purposes over established naval air mail routes. It is understood this order will conclude naval aviation purchases for the current year, as the Navy Department recently closed an order for 20 deHavilland *Tiger Moth* planes for training purposes.

THE BRAZILIAN government is considering the construction of an airplane factory at Bello Horizonte, state of Minas Geraes and it is understood that a commission of naval aviation officers is making a preliminary survey there. While no definite decision has been made, the project will in all probability materialize within the next six months. No information is obtainable as to the nature and extent of the factory, although it is understood the government intends to manufacture initially only the structural parts of the planes. Later on, engines may be assembled in the factory.

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COOPERATIVE EFFORT

(*Continued from page* 19)

age extent of more than 10,000 miles per year is an established policy with 40% of the sales forces and 60% of the executives in the firms queried, yet only 200 company-owned airplanes are to be found today in industries other than aviation. This limited usage again indicates the need of a general attack, rather than continued sniping, even by expert marksmen.

Look for a common denominator among airplane owners. This is not going to be an easy task when there are flying grandmothers and grandfathers, as well as flying schoolboys and girls—when it is realized that even back in the prosperous years, more than 40% of the non-commercial owners of aircraft possessed incomes of less than $5,000.

The customary group classifications, of course, should be explored. But the most useful denominator will turn out to be one of personal temperament and characteristics. A person of sedentary habits, indifferent health and matter-of-fact disposition, may occasionally travel the airlines for convenience or necessity. But the man or woman whose face lights up when you speak of owning a plane is more likely to have *these* traits: the love of action and of speed; the nervous alertness of enduring youth; the enjoyment of good health; the urge to become a participator rather than a spectator; the individuality of the non-conformist. Check these traits against credit rating and you have a prospect, at least in the essence.

It is not practical for the individual manufacturer to search out and record such people in great numbers. But this could and should be done by a permanent research division set up under a cooperative plan. This finding and registering, classifying and indexing of likely prospects (not in retail units as now, but by the gross and by the carload) would be a major objective of any cooperative program. It is a task that must be undertaken if the industry's rate of progress is to be greatly accelerated.

A final objective, to induce the prospect himself to step forward, calls for a program of cooperative advertising and sales promotion. The writer does not presume to advance any winning formula for effective exploitation. A combination of the best minds in the industry would, after due study, outline the procedure.

Edward Bernays has this to say about minorities: "Minority movements attain a success that has no basis in logic. They succeed for two reasons. The first is that they are vociferous. They organize actively and shout their views. The second reason is that the majority does not organize against them."

The field of the privately-owned airplane may be said to be a minority field. While there is no majority organized against us we do face a deadly inertia. We will not overcome that handicap until we become more *vociferous,* and indeed unless we raise our voices in a resounding chorus. This is a job for a group effort, by the industry, as a whole.

BOEING SCHOOL TRAINING

(*Continued from page* 23)

and Stinson Trainers with Lycoming engines, and Boeing 40-C and B's with Pratt & Whitney Wasp and Hornets. The Hornet job is completely equipped with blind landing apparatus. Besides, there is a Hamilton 8-place monoplane with a Wasp engine, and a Ford tri-motor transport with three Wasps, the latter being completely equipped with all instruments used on modern airliners, so that a full course of visual and instrument flying, even to blind landing, is part of the training.

The Bureau of Standards has recently located one of the new landing beam beacons at Oakland Airport, whose use is shared by the Boeing students and the flying personnel of the Oakland Division of United Air Lines.

A foundry department was added in the metals shop; the photo-elastic equipment has been improved; and the communications shop has been doubled in size. Experimental work with short-wave transmitters has been authorized by the Federal Radio Commission and call letters WIOXAZ have been assigned to the radio school department.

The practical nature of the course given is visualized by the placement of Boeing graduates in spite of recent retrenchment in the field of air transport, due to outside factors and economic conditions. During the past year 96 men were graduated from the various courses and of these 10 remain for post graduate work. Sixty-nine graduates, or 72%, of the total number to finish, found places in the industry as co-pilots, operations engineers, aeronautical engineers, engine, airplane and metal mechanics, instrument men, instrument technicians, radio dispatchers, electricians, field secretaries, traffic men and approved school instructors.

Correspondence courses are carried on also for employees of United Air Lines. These courses recently having been made available to any person engaged in the aviation industry, or who has had sufficient aeronautical experience to enable him to master the advanced part of the instruction. These courses are: Aircraft Communications, Aircraft Power Plants, Airplanes, Aviation, Meteorology & Aircraft Instruments.

I do not know just what the future of transport aviation is going to develop into, nor just what direction its engineering and operations work will take, but from the thoroughness of method which was impressed on me by my visit to the Boeing School I would gamble that graduates of schools of this sort will make much more of an impression on the aviation industry in the next decade than the graduates of our present technical universities.

It is a comparison of *pedagogical education* over *commercial training* for a life work,—and after all, perhaps, the main objective of any so-called education must eventually be its fitness for the earning of a livelihood for one's self and his family.

TRADE LITERATURE

Aeronca C-3

• FOUR-POINT Flying is the title of a small and compact folder issued by the Aeronautical Corporation of America, Cincinnati, Ohio, manufacturer of the Aeronca series of planes and engines.

Featuring descriptions and specifications of the E-113-B engine and Aeronca C-3 plane, the leaflet is particularly well put together and tastefully presented. The last page is interesting in that it illustrates a rear view of the plane, the skeleton fuselage and wing, and the instrument panel.

Zinc Chromate Primer

• THE AVIATION division of Berry Brothers, Detroit, Mich., suppliers of finishing materials used by American airplane and seaplane builders, has just published, and will supply gratis to those interested, a small folder covering briefly the history, the physical properties and the proper methods of handling the new corrosion inhibiting Berryloid Zinc Chromate Primer. This product was developed to meet the Navy's requirements for a primer providing maximum protection of all metal surfaces, including dural, aluminum, alclad, steel and cadmium plated parts, against the conditions encountered in Naval air service.

Ort Catalogue

• THE NEWEST catalogue of aeronautical merchandise sold by Karl Ort is most useful from a number of standpoints. Besides listing hundreds of items for the pilot, mechanic and manufacturer, it provides an insight to one of the largest aircraft supply houses in the country.

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AIRCRAFT

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5.	LAMBERT:	2-place, high wing	71
6.	LAIRD:	Open cockpit & cabin	65
7.	PORTERFIELD:	2-place, high wing	61
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26.	MACWHYTE:	Tie rods, cable	69
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GREY'S AIRWAY BLUFF

(*Continued from page* 17)

plywood. Outer covering of fabric over formers. Space between packed with Cabot's Quilting to deaden nose." (My grandmother used to sleep under Cabot's Quilts, and she was half dead at the time and didn't mind the noise.)

So here, we see, is Mr. Grey, boasting —actually boasting—about an English machine using a cheap and antiquated form of construction that we in this country gave up years ago in airline transports. If you told an American airline passenger that his airplane was "a wooden box structure" he would instantly be reminded of the flaming coffins, as the old war-time D.H.'s used to be called, more in sorrow than in anger, mind you!

From his own words, in *Jane's,* I take these two comparative descriptions of the tail units of the Boeing and his admired D.H.86. Boeing tail unit: "Normal cantilever monoplane type. All surfaces of aluminum-alloy, including covering. Boeing patent trailing-edge flaps for trimming on rudder, elevators, and one aileron. Non-adjustable tail plane." Absolutely modern, as Mr. Grey kindly admits. But what has he to say of his D.H.86, the pride of the English airlines? D.H.86 Tail Unit. "Monoplane type with wire bracing. Tail-plane adjustable in air with screw-jack beneath front spar. Fin adjustable in air with irreversible screw-gear. Balance flap in trailing edge of rudder is automatically biassed by adjustment of fin. Wooden structure covered with plywood throughout." That form of construction is so antique that it is venerable; I wouldn't think of passing a D.H.86 without raising my hat, for I always show respect to the aged. Furthermore, an adjustable tail plane—and adjustable from the front spar, mind you!—is an abomination and a flutter-point. Yet Mr. Grey has the audacity to mention this old-fashioned contraption in the same paragraph with the Boeing and the Douglas! The effrontery of the man!—(I'm going to look effrontery up in the dictionary some day and find out just what it means. But it sounds very effective to hurl in at this point.) Yes, the insolent assurance of the chap! The unblushing impudence of the fellow! The—the—in short, the effrontery of him! Tck! Tck! Tck!

Of course, it may be unfair to compare our grand Boeing 247-D with an old-fashioned structure like the D.H.86, but Mr. Grey said, "Now compare that bunch with our D.H.86," so he has only himself to thank for calling our critical editorial attention to a humble aeroplane that previously we had considered beneath our notice—or, for that matter, beneath the notice of anyone seeking modern equipment for a modern airline. Of course, for some poor struggling airline in Australia (where the natives are permitted by law to spend their money only for English aeroplanes in spite of their overwhelming preference for American planes) such a shoddy and peculiar conglomeration of wings, struts, and engines as the D.H.86 may find favor. Over here we have only a few places for it, like the Smithsonian Institution or Roosevelt Field Museum with the other relics. It was built too late, unfortunately, to find a spot in the late P. T. Barnum's collection.

Perhaps it is unkind to carry the comparison further, but I always like to oblige dear Mr. Grey—and as he asked for this, I haven't the heart to disappoint him. There is the matter of ceiling—and over here we consider that an important matter, for many times our great transports, the world's very best, go up above bad weather and cruise along in the moonlight, while the poor old D.H.86 would, of necessity, in the same circumstances, be left far below, plugging along forlornly through the fog calling frantically with his "wireless." The Boeing 247-D has a service ceiling of 25,400 ft., and an absolute ceiling of 27,200 ft. The D.H.86, on the other hand—and on a lower level—has, according to Mr. Grey himself, a service ceiling of 19,000 ft., and an absolute ceiling of 20,500 ft.

It is in the event of engine failure, however, that the superior efficiency, the undeniable supremacy of the Boeing 247-D places it above the clouds, with the unfortunate wooden D.H.86 poking murkily along beneath—far, far beneath. For on only one engine the Boeing 247-D with full load has an absolute ceiling of 11,500 ft. (In *Jane's* Mr. Grey reports this ceiling, incorrectly, as 6,000 ft.) But the D.H.86, again according to Mr. Grey in *Jane's,* has only 6,000 ft. ceiling on two of its four little engines, with one on each side, and only 3,600 ft. on two engines, both on the same side. Thus with half of its power shut off, the Boeing still would have a ceiling of 11,500 ft., and the D.H. in a similar predicament might have only 3,600 ft. Yet Mr. Grey exults, as he simmers down at the end of his explosion: "—in spite of all our detractors, and in spite of our own habit of depreciating our own work, (!) we are so far ahead of our competitors." Happy Mr. Grey!—in the middle again!

Well, well,—I've had such a pleasant time making the friendly comparison that my dear dear friend Grey urged me to make that I have run over my allotment of space and must defer to the July issue of Aero Digest a discussion of many interesting points and deft mis-statements of fact which C.G.G. has perpetrated in his Great American Airway Bluff, which should receive the 1935 Pulitzer Prize for outstanding fiction. I shall take up such matters of moment as the Douglas, the Northrop, the Vultee, and D.H. Comet, the Lockheed Electra, and the speeds of American, as contrasted to English airlines.

Just a final word about the Boeings: Of Mr. Grey's statement that the average operating speed of United Air Lines is 121 m.p.h., Mr. Johnson of United writes: "In discussing operating speeds he is again in error. One needs only to check our schedules against the mileage of our route to prove this point. For example, on June 1 we will inaugurate a San Francisco-New York schedule of seventeen hours, which is an average speed from time of departure from San Francisco until time of arrival in New York of approximately 160 miles per hour, which *figure includes all of the time for six intermediate stops enroute.*"

Mr. Grey says: "In America, where the card game of poker is the second most popular indoor sport, bluffing has become more than a fine art,—it has become a national industry." All right, C.G., I'm still in the game . . . I'll see you—and raise you two.

(*To be continued*)

PERSONAIRLITIES

(*Continued from page* 54)

of their lot, and complaining that they haven't a chance these days. But in a long and largely miss-spent life, I've come to this conclusion: if you have anything of value in you it will come out, despite all of your early handicaps.

Young Owles certainly got off to a poor start. With six other young Owles romping about the family domicile he had but little chance to practice Art undisturbed. But nevertheless he practised it so assiduously that at the age of 14 he won a scholarship in the Nottingham School of Arts Academy, where some of England's greatest artists have studied. Here Alfred studied the work of other artists and developed rapidly under competent instruction. There are no "born artists" or born writers or born airplane designers—that is a myth. They develop, by hard work and application to the principles of their trades, what was at the beginning no more than a wish, an urge to express themeselves. With hard work they nourish the little spark of hope that glowed within them, and finally it flares up in the full flame of genius. And we less persistent mortals look at these chaps and say, "He was born lucky, that fellow! Look—he's even making money. He isn't on the County!" I've felt that way, myself, about successful writers. But my unhappy faculty of analysis always hits me with the truth, and I have to admit, "You lazy old rascal, if you weren't a born loafer you might have got somewhere yourself."

Bleriot's flight across the English Channel turned Owles' thoughts to aviation. Here was something new and romantic to illustrate; from that time on most of his work had to do with adventure in the air. The result of his efforts today forms an important part of America's art having to do with aviation. His pictures, all air subjects, have been exhibited in Los Angeles, San Francisco, and Chicago, under the sponsorship of Gustave Courvoisier, well known Western exhibitor. There is life and movement in these pictures, the very spirit and courage of aviation itself. No judge of Art, as art, I yet can assert that these pictures embody the feeling of the air world, the sense of speed and accomplishment and triumph that is an essential part of aviation.

Owles had no easy time of it. He came to the United States in 1914, because he had seen the numerous illustrations in American magazines and figured that a young artist would have a better chance here than in an older country. He found the place full of artists, some of them washing dishes in restaurants. However, he was determined to become an American and throw in his lot with us rebels, so he joined the American Army, thus severing the last of the home ties. He joined at Fort Slocum, N. Y., saw service in the Philippines, eventually ending up as Sergeant, observer, and aerial photographer in 127 Aerial Photographic Squadron in the Air Corps. After the war he went to work on the Vaudeville News with Ben Bernie's pal, Winchell. Walter wrote about the acts while Alfred cartooned them. But he never lost his touch with aviation, and when he went to California he did pictures for Shell Oil Co., Richfield Oil, Fokker, Pacific Flyer magazine, and Western Flying. He flies frequently as a passenger, gathering impressions for his air pictures, which reflect aviation as it really is. There is about his work a vital quality that I feel certain will insure it enduring fame.

BOOK REVIEWS

HANDBOOK OF INDUSTRIAL FABRICS

By George B. Haven

• DATA AND information in textile research is becoming more important as many engineers, buyers and commercial organizations today are demanding knowledge of the physical properties of textile materials before purchasing.

At this time practically every known engineering material is purchased against accurate specifications, and this practice has extended to textiles. The handbook is a ready reference volume, putting into convenient form the data pertaining to fabrics, etc. Its seven chapters provide information on the types of cotton; manufacturing processes; uses of industrial fabrics; laboratory and design practice; and specifications and test methods. In addition to many illustrations, there are 52 interesting and informative tables. A report of a test on airplane cloth was especially illuminating.

Wellington Sears Co., New York, N. Y., are the publishers.

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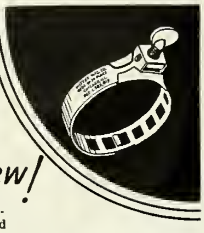

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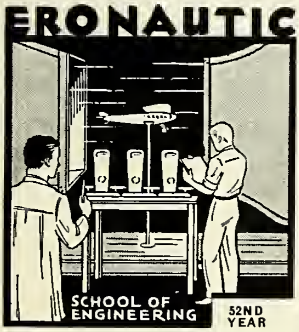

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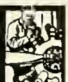

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1934 CABIN WACO: Privately owned; equipped with Jacobs engine and many extras. This ship is in first class condition and a real bargain. Troy Flying Service, Troy, Ohio.

FOR SALE: Challenger Robin, good condition; Goodrich air wheels, Hamilton steel prop; licensed until October. Motor less than 50 hours since overhaul. Flyaway, $1,150. Brayton Flying Service, Inc., St. Louis Municipal Airport, Robertson, Mo.

AERONCA C-3 SEAPLANE: Always kept in perfect condition. Specially rust-proofed throughout. Motor and pontoons just completely overhauled. Price, $1,250. Viking Flying Boat Co., Florida, Inc., P. O. Box 3302, Miami, Florida.

1933 STINSON: Good as new, 80 hours since major overhaul; equipped with radio, flares, landing lights, complete blind flying instruments, 74 gallon gas tanks; privately owned and flown by expert pilots; must sell; price right. See it before you buy. Room 906, 82 Wall Street, New York, N. Y.

STINSON TRIMOTOR Model T: $2,500. Waco J-5 Straightwing, $1,000. Ken-Royce 185 h.p. Challenger, $1,250. Fairchild FC-2, $900. Cessna J6-7, $1,500. Licensed, excellent condition. L. D. Sherrick, Canton, Ohio.

STINSON SM2AA: Whirlwind 175; 4-place; time 450. Licensed 8441. Hamilton adjustable prop, turn-bank; recovered. New OX-5 motor. Taylor Campbell, Bonaparte, Iowa.

PITCAIRN AUTOGIRO: 300 h.p. Wright engine, 3-passenger. Flown 800 hours. Any reasonable offer takes ship complete, or will sell engine, rotor blades, other parts separately. AERO DIGEST, Box 2069.

FLEET KINNER: Front exhaust; 75 hours since overhaul; full airwheels, airspeed, compass, turn and bank, standard instruments in both cockpits; excellent shape. $1,150. Verville Sport Trainer: Continental 165; Heywood starter; turn and bank, compass, airspeed, standard instruments in both cockpits; semi-airwheels, brakes, tail wheel, airmail type windshields, front cockpit cover; cruises 95; less than 400 hours total time. $1,350. OX Robin: 165 hours total time, $450. Taylor Cub: 20 hours total time, one month old; $1,250. Can finance this ship. Meinke-Eldred Flying Service, Willoughby, Ohio.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

● PLANES and ENGINES FOR SALE

TRAVEL AIR 2000, OX-5: Licensed until November 1935. Duals, DH wheels, new prop. Always hangared. $400. Ivan Munroe, Airport Manager, Tallahassee, Florida.

BELLANCA SENIOR DeLuxe Skyrocket: Serial No. 621, 6 PCLM, Wasp SC1. Factory reconditioned; dual controls, standard instruments and accessories, including flares, landing lights, Hamilton Standard controllable pitch propeller. Engine time since motor overhaul—none. Upholstery optional, color optional; airplane is being completely overhauled and recovered. Price, $9,800. Bellanca Aircraft Corporation, New Castle, Delaware.

PORTERFIELD FLYABOUT: $1,595-$1,795. Planes or autos in trade. Terms. Free instruction to purchasers. Advice club formation. Dick Schall, Berwyn, Md. Telephone: Greenwood 1676.

WACO F: Kinner B-5. Licensed till October 1935. 610 hours total time. Never cracked, always hangared. Priced for quick sale. No trades. Meadville Airport Co., 572 Chestnut Street, Meadville, Pennsylvania.

TWO TRAVEL AIR OX-5's: Licensed January 1936, Millerized; Scintilla, 30 x 5 wheels; $600 each. Turns 1400. Warner Aristocrat: Bargain, $850. 2 OX-5's, overhauled. Transport pilot, 4000 hours day and night, go anywhere. Brockenbrough, Chapel Hill, North Carolina.

FAIRCHILD 22: Powered with Cirrus Hi-Drive. This airplane only 18 months old. Total time 330 hours. Major overhaul at 300. Completely equipped as blind flight trainer, including radio, turn and bank, rate of climb and blind flying hood. This airplane perfect in every way. Will accept trades. $1,750. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO F KINNER B-5: 350 hours, fabric excellent, black with red wings; Heywood starter, baggage compartment, navigation lights. $1,700. Will accept ship in trade. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

OXX-6 WACO: Licensed, perfect condition, 150 hours since major; snappy color combination; only $485. Also, licensed OX-5 Travel Air, $375. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

AERONCA DISTRIBUTORS: New and used Aeroncas sold on time. Few '32 Aeronca parts, cheap. Deluxe Monocoupe, 51 hours, $2,500. Tred Avon Flying Service, Easton, Maryland.

MUST SELL 6-place Travel Air, just relicensed; J6-9 motor just majored, modernized and shielded. Equipped for photographic work and night flying. Will trade. A. R. Burnham, 2722 Larimore Avenue, Omaha, Nebraska.

S-39 SIKORSKY: Completely overhauled. Wasp C Lockheed Vega, $4,500. Loening Commuter, $4,000. Fairchild 71 on floats, $4,500. O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y. Telephone: NEwtown 9-0300.

FOR SALE: Warner and Cirrus Fairchild 22's. Fairchild 24. Lambert and Warner Monocoupes. J6-9 open Travel Air. Bellanca Pacemaker. Bellanca Skyrocket. Lockheed Vega. Wasp Laird. Stinson S. Stinson Reliant. Waco F-2. J-5 Stearman. Challenger Robin. Jacobs Beechcraft. Waco Cabin. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

MONOCOUPE LAMBERT 90: A-1 condition. Always hangared and privately owned. High polish finish in standard Monocoupe color. Equipment includes metal propeller, racing landing gear, semi-airwheels, pants and full set instruments. Licensed until February, 1936. Will sacrifice for $1,500. Frank Miller, McConnell Field, Nashville, Tennessee.

J6-9 TRAVEL AIR 6000-B: $2,750. Latest 1931 model. Eight hours since complete recover and motor overhaul. Wonderful buy. Licensed June 1936. Alton Walker, 600 Graphicarts Bldg., Kansas City, Missouri.

OX-5 WACO GXE: Licensed; excellent condition; 30 x 5 wheels; motor just top overhauled; extra motor and prop. $500 cash. Francis Kane, R. D. 3, Wellsville, New York.

BUHL PUP: 210 hours since new. Excellent condition; motor perfect; medium wing span; $450; extras. Al Curry, St. Louis Flying Service, Lambert Field, Robertson, Missouri.

WARNER WACO F: Recovered, hand rubbed; now majoring motor, installing new heavy duty crankshaft; complete night flying equipment. Licensed to April 1936. Practically a new airplane and priced to sell at $1,450. Ed. Conery, 1527 Hawthorne Avenue, Minneapolis, Minnesota.

PITCAIRN PA-6: Equipped with air wheels, brakes, duals, battery, starter, blind flying instruments, bonded and shielded for radio. Three extra wing panels included. Priced for quick sale. AERO DIGEST, Box 2071.

WARNER STINSON: 4-passenger cabin; recovered fuselage, tail group, doped wings, motor 50 hours since major; steel propeller. Make offer. AERO DIGEST, Box 2072.

LAMBERT: Just majored; master rod; all bushing by factory; Standard steel propeller reconditioned by Pan-American. Lambert Monocoupe tail group, good condition; Bendix wheels with brake, tires, tubes. Make offer. 272 West Flagler St., Miami, Florida.

HUNDREDS OF AIRPLANES: $40 up. Crack-ups, motors, parachutes. Every location. Directory with owner's price, name and address. 20c postpaid. Used Aircraft Directory, Athens, Ohio.

J-5 STINSON: 6-place; licensed, good condition; rubbed finish. 12 hours since major. Good performance, excellent money-maker. $1,200 cash, trades considered. AERO DIGEST, Box 2073.

WACO 90 GXE: Latest type; licensed, in excellent condition. Beautiful color combination. Cash, $650. Will consider car or ship in trade. K. S. Seibert, 2521 Lillie St., Fort Wayne, Indiana.

FOR SALE: Invincible 4-place midwing cabin. 185 h.p. Challenger, steel prop. Excellent condition. Will take cheaper ship or car in trade. Harry Deuter, 318 West Washington, Fort Wayne, Indiana.

KINNER K-5 American Eagle: Short-nosed model. New tires, new propeller, cover good. Cash or trade. 100 h.p. steel propeller, bargain. Bob Curry, Seymour, Indiana.

CHALLENGER FLEDGLING: 53 hours since Curtiss-Wright major overhaul. Six extra cylinders and parachute. Relicensed until May 15, 1936. Mechanically and structurally perfect. Never cracked. Stanley, 2347 Newbold Avenue, Bronx, New York.

WACO TEN: $375. Licensed, new covering, everything except fuselage. Orange and black. Give small difference for two or three-place Warner job, less motor. Consider slightly damaged ship. Douglas Peercy, Box 12, Skiatook, Oklahoma.

WACO 1934 CABIN: Model YKC; Jacobs motor; perfection condition. 70 gallon tanks, flares, landing lights, complete blind flying instruments, radio; 200 flying hours. Priced reasonably. AERO DIGEST, Box 2074.

KINNER BIRD: 30 hours since complete recover and complete major overhaul on ship and motor; new air wheels. Guaranteed to be like new throughout. $1,175. Ralph Schellenberger, 4114 Irving Park Blvd., Chicago, Illinois.

FAIRCHILD KR-34: Wright J6-5, completely modernized including impeller clutch; fuselage and tail surfaces recovered. Full set of instruments, including rate of climb, bank and turn. Eclipse starter, oleo landing gear, semi-airwheels, brakes, pressure fire extinguisher. This airplane is in splendid flying condition. Price, with white silk parachute, $1,000 cash. W. R. Gibbs, Holly Oak, Delaware.

J-5 PITCAIRN Sport Mailwing: Just completely recovered; special rubbed finish; motor majored, ship and motor like new. Hamilton steel prop, full set of instruments, rate of climb $1,600. Aeronca C-3 right wing spars and cracked wing. Frank Romano, Teterboro Airport, Hasbrouck Heights, New Jersey.

OX LINCOLN PAGE: Cheap. Licensed April '36; new prop, pyralin; engine top overhauled. Plane good condition. Cash for Kinner Bird. LaRue Coy, R. R. 3, Seymour, Indiana.

HEATH PARASOL: Powered with Wright Morehouse motor. Special built undercarriage, airwheels. Ship like new, exceptional performance. Cash or will trade for larger plane or late model car. Central Air Service, Grand Rapids, Michigan.

WE WILL TAKE your ship in trade on any new Fairchild. Send complete description of your airplane in first letter and we will quote trade-in value. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

TRAVEL AIR SPORT: 125 h.p. Kinner; perfect condition; $1,650. LeBlond 5d engine, $150. Full Airwheels 20 x 8 x 4, $75 pair. Kinner parts, side exhaust engine complete. Dick Schall, Berwyn, Maryland.

$850—LATE MODEL Kinner American Eagle: Just majored, airwheels, many extras; perfect; easily worth $1,000. See this airplane. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

LESS MOTOR: NC licensed J-5 Straightwing Waco, excellent condition; equipped with night landing lights, but less motor. Michigan Aero Motors, Jackson, Michigan.

LESS MOTOR: 6-place Stinson cabin ship, NC licensed and in beautiful condition, new Airwheels and brakes. Less J-6 330 h.p. motor. Will accept good light air-cooled ships on deal. Michigan Aero Motors, Jackson, Michigan.

WACO F-2: Continental; $2,750. Recovered, motor majored. $1,000 extras. Privately owned, little time, never cracked or stunted. Alton Walker, 600 Graphicarts Bldg., Kansas City, Missouri.

J6-7 STEARMAN: Excellent condition, with many extras; motor just overhauled at cost of $539. J6-5 motor, completely overhauled and modernized. J-5 motor just overhauled. Many other reconditioned Wright, Scintilla and Stromberg parts at substantial saving. General Airmotive Corporation, Cleveland Airport, Cleveland, Ohio.

1932 WACO CABIN: 210 Continental; 375 hours; 25 hours since top overhaul. Lear radio, rate of climb, turn and bank, good condition throughout. $2,750 cash, Atlanta. Will accept lighter plane in good condition in trade. Full particulars to interested party. W. D. Owens, 1207 E. Rock Springs Rd., Atlanta, Georgia.

FOR SALE: 3-place OX-5 Swallow, just recovered and relicensed. Steel propeller, Bendix wheels; price $450 or trade for OX-5 Robin. John Ruzicka, Peru, Indiana.

CURTISS-WRIGHT JR.: Powered with Szekely. Engine just major overhauled. Airplane completely refinished. New propeller. Just relicensed. Price $400. Claude Chamberlain, Rochester, Ind.

WHAT AM I OFFERED cash? New Jacobs 170, latest type guaranteed. Motor has only 5 hours. McPherson, Abingdon, Pennsylvania.

FOR SALE: Waco F-3 and Waco F-2, powered with 210 Continental. Perfect condition. Licensed June 1936. Jack Gillies, Aviation Country Club, Hicksville, L. I., N. Y.

VELIE CAVALIER: New engine and propeller. 58 hours total time. Licensed. $485 or will trade for late model Ford or Chevrolet. Ben Glick, Blackwell, Oklahoma.

COMMAND-AIRE OXX-6: Scintilla and Dixie mags; 5 hours since major overhaul; just redoped; licensed until May 1936. Standard instruments, compass, excellent condition; $525. Richard Aubry, Archbold, Ohio.

FOR SALE: Our 20-passenger Wright Cyclone-powered Keystone Patrician, newly completely recovered and refinished throughout. Motors major overhauled. NC licensed to May 1936. The greatest barnstorming attraction in America. Eligible for export. Will accept late model ships or late model cars on deal. Address owner: Edw. A. Forner, Jackson, Michigan.

LOCKHEEDS: 3 Orions, manufactured 1934. Wing flaps, two-way radio, all Sperry instruments, S1-D1 engines, controllable pitch propellers. Cost new, $32,000. Specially priced, $12,500. Vegas, Wasp engines, $5,500 to $7,000. Babb, 1100 Airway, Glendale, California.

11 AIRPLANES for sale or trade: Stinson Sr., six-place, J6-9; Driggs Skylark, Rover powered; 2 J6-5 Travel Airs; 2 J-5 straightwing Wacos; Kinner B-5 Waco F; Lambert Cavalier Coupe; OX Travel Air; OX Waco 10; Heath Parasol powered with Wright Morehouse. Trade in your ship or will accept cars of late model. Terms if desirable. Two almost new white silk Irvin seat parachute. Steel propellers for J-6 and J-5. Few brand new Hamilton wood props at $15. Flottorp, Marshall and Bennett carried in stock for all motors. Write for details. Central Air Service, Grand Rapids, Michigan.

RELIANT STINSON: Landing lights; perfect shape. Waco F: Like new; starter, steel propeller; and J-6 Robin. These ships are priced to sell. For particulars write Burnham Miller Flying Service, Municipal Airport, Omaha, Nebraska.

FOR SALE, ENGINES: Continental 165 h.p., majored, 119 total hours, Heywood starter and all accessories. LeBlond 65 h.p., majored. OXX-6 engine in perfect condition. Warner 90 h.p.; Velie M-5, majored. Priced to sell. Dunaway Garage, 2201 Indiana Avenue, Kansas City, Mo.

SPARTAN 3 POLB: Walters powered. Complete list spare parts goes with engine. Both ship and engine in excellent condition. $675. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

J6-5 STRAIGHTWING WACO: Fuselage recovered, high lustre finish; engine majored and modernized; electric starter; $1,375. Waco Cabin: 210 Continental, factory major, $2,250. Warner Stinson: total time 420:20, equipped with side-by-side duals; price, $850. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

● PLANES and ENGINES FOR SALE

FOR SALE: Lambert 90 Monocoupe; in excellent condition. Semi-balloons, brakes, Hamilton steel prop, standard instruments. $850 cash, no trades. Olger Grove, Hillsboro, North Dakota.

VERVILLE BIPLANE: 2-place, 165 Continental; excellent for sport or training; 80 hours since real major on engine; covering A-1; dual instruments, dual brakes, semi-air wheels, self-starter; plane is perfect in every respect. $1,100. J. W. Lytle, 2333 Vodeli St., Pittsburgh, Pennsylvania.

BIRD: Kinner 100; licensed May 1936. Plane and engine perfect condition. Complete set of instruments. Extra propeller. Airwheels. No trades. $1,100 cash. Roy Matthews, Hangar 25, Roosevelt Field, Mineola, New York.

MERCURY T-2 TRAINER: Recovered; 90 LeBlond, majored; licensed April '36; ship like new; $975. Aristocrat: 3-place cabin; 125 Warner, majored; speed ring, brakes, etc.; licensed May '36; $1,260 or will trade either or both ships for late 4-place Stinson, Waco or similar 4-place cabin job. Velie 65 Monoprep: Licensed May '36; new paint, excellent, $585. Al Whitney, 6 Beech Street, Garden City, L. I., N. Y.

KEYSTONE LOENING COMMUTER: In A-1 condition (40 hours since new). "D" type J-6-300 with 17 hours since major overhaul; full set Pioneer instruments; NC licensed. Lycoming Stinson S: Completely reconditioned and engine major overhauled; full set Pioneer instruments; NC licensed. For further information or inspection of either ship: Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

AERONCA C-3; Rover Driggs; J6-9 Travel Air B-4000; J-5 Eaglerock; all licensed and very reasonably priced. Send for details. Air Activities Airport, West Chicago, Illinois.

J6-9 FORD TRIMOTOR: $4,750 for quick cash sale. Perfect throughout. Deliver anywhere. Licensed, 11 passengers. Latest model. Picture. Alton Walker, 600 Graphicarts Bldg., Kansas City, Mo.

BELLANCA PACEMAKER: Powered J6-9. Ship cruises 120. Turn and bank, rate of climb, landing lights, flares, starter. Will accept trades. $3,200. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

AMPHIBION: Privateer P-2; two-place monoplane, dual control, licensed to May 1936. Warner motor; $875 cash. Always privately owned. M. C. Bradley, Somers Point, New Jersey.

OX-5 TRAVEL AIR 2000: Motor practically new, ship excellent condition. Dual controls; good covering. $485 or trade for late car. C. W. Carnes, Comanche, Texas.

CURTISS ROBIN: 3-passenger cabin monoplane with OXX-6 twin ignition 102 horsepower motor. Just relicensed, excellent condition throughout. $500. J. Bashioum, 347 Marsh, Erie, Pennsylvania.

DH GIPSY MOTH: Licensed to October; full Airwheels; racing windshields; Pioneer airspeed; wing slots; total time 550 hours; recently recovered and top overhauled; excellent condition; $800 cash. W. R. Reese, Box 480, Greensboro, North Carolina.

WARNER CESSNA: 125 h.p. Licensed till November. Engine, since factory remodernized, 185; ship, 460. Never cracked. Pioneer instruments. Extras: Compass, bank and turn and low pressure wheels and brakes. $1,050. Frank Davis, 514 Washington St., Lead, South Dakota.

FOR SALE: Bellanca Skyrocket. Privately owned, never cracked. Western Electric radio. 10:1 blower. Recently factory overhauled and recovered. Priced right. Bellanca Pacemaker: 400 Wasp Jr. Radio, controllable pitch propeller. Night flying equipped. Parachute seats, pants; wonderful condition. Privately owned. Aeronca C-3 seaplane: 126 hours total time; privately owned. Two Aeronca type C-3: Excellent condition, never cracked. New Standard D-25: J-5 motor; low time; night flying equipped. Unger Aircraft, Inc., Hadley Field, New Brunswick, New Jersey.

FAIRCHILD 24: Powered with Warner 145 Super Scarab. Only 4 months old. Has landing lights, flares, starter. $4,385. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

KINNER BIRD: Air wheels, brakes, perfect condition; 20 hours since overhaul. Priced for quick sale by private owner. Carl F. Greer, 930 Dove Lane, Louisville, Kentucky.

OX-5 CHALLENGER: Completely rebuilt and refinished. New motor, prop and Airwheels. Airspeed and front seat altimeter. NC licensed. Reasonable. C. G. Hollinger, 705 Brother St., Ludington, Michigan.

MONOCOUPE: Velie 65. Split type landing gear, 32-foot wing. New motor. New covering. Licensed. $575. Richard Riedel, 936 Lansing Ave., Austin, Minnesota.

EAGLEROCK A-3: 180 Hisso; Army overhaul. Total ship time, 135 hours; engine 48 hours. Just relicensed; partly recovered; all refinished; lights. L. Cameron, 1383 Gladys Avenue, Lakewood, Ohio.

SAVOIA AMPHIBION: Complete parts, including Kinner 125 with Heywood; rebuilding for personal use of pilot transferred to the Caribbean. Almost ready for recovering and assembly. Plane in Philadelphia. Bargain for immediate sale. W. Masland, General Delivery, Coral Gables, Florida.

WACO 3 POLB: Wright J6-5; inertia starter; brakes; steel prop; licensed; always hangared; excellent condition. Price $1,250 or will trade on Deluxe Monocoupe. G. H. Dusman, York, Penna.

WALLACE TOUROPLANE: 3-place cabin monoplane; damaged, but easily repairable. $100 less motor or will repair. Takes Kinner K-5. John D. Jacob, Malvern, Pennsylvania.

LAIRD J6-9 (modernized to "D"): Ring, pants, semi-airwheels and brakes, other extras. Cruises 140, top 170. Total 415 hours, 215 since major. License expires September. Finished silver, trimmed red and black. All struts and wires chromium. Beautiful job, fine condition. For immediate sale, offered at $1,400. No trades. Chicago. AERO DIGEST, Box 2075.

KINNER BIRD: Completely recovered; engine major overhauled; looks like new; just relicensed; $1,200. J. V. W. Corp., 534 Broad St., Newark, N. J.

ENGINES: Majored by appoved agency. Hornet B, $1,500; Hornet A-1, $850; Wasp S1-D1, $2,500; Wasp C, $1,100; Wasp B, $750; J6-9 "D," $950; J6-7 "D," $750; J-5, $500; Warner 125 h.p., $475; Kinner K-5, $300; Lycoming 215 h.p., $675. Babb, 1100 Airway, Glendale, California.

PITCAIRN J-5: Ten hours since major on engine. Airplane in splendid condition. Will accept trades. $1,250. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

STINSON: 6-place, J6-300, very good condition; 200 hours since overhaul. Electric starter. Best offer takes airplane. Will consider trade. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

FLEET: Kinner K-5 front exhaust; reconditioned, overhauled; perfect condition. Porterfield with LeBlond, brand new, few hours; special finish. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

FOR SALE OR TRADE: Curtiss Sedan; 4-place cabin. 185 new type Challenger. Covering 15 months old. Special gloss finish, cream and red. Night and blind equipment. Licensed January. $2,000. W. P. Corrington, 1220 West 9th Street, Cleveland, Ohio.

OUTSTANDING BARGAINS in Used Planes: New Fairchild: 125 Warner motor, NACA cowling, pants, steel prop, brakes; total time 50 hours; $2,700. New Great Lakes Trainer: 95 h.p. Cirrus motor; $1,800. Stinson R: Landing lights, flares, leather upholstery, pants, NACA cowling; total time 500 hours; motor recently factory overhauled; $2,300. Stinson SM8A: Full air wheels, bank and turn, rate of climb, motor factory overhauled and modernized recently; total time, 780 hours; $1,800. Aeronca Biplane: Total time 188 hours; like new; price $1,700, complete. Fairchild 24 cabin: 125 h.p. Warner motor; ring, wheel pants; like new; total time 250 hours; $2,300. All in perfect condition. E. W. Wiggins Airways, Providence, Rhode Island.

STINSON S: With land gear, floats and skiis. First class condition; licensed to December. $2,900, cash only. Want good Hisso E-2 engine. Wisconsin. AERO DIGEST, Box 2081.

AMERICAN EAGLE: Model 201; short nose. Kinner K-5; airwheels, dual controls, navigation lights, full set instruments, licensed, A-1 condition. Sacrifice, $800. Archie MacDougall, Pembina, North Dakota.

WACO F: Kinner 125. Only 360 hours. Never cracked. Latest heads, costing $350. Best offer over $1,500. Steel prop, ring, starter. Taylor Cub: 700 hours; new Continental motor; $750. Bob Trader, Dravosburg, Pennsylvania.

AERONCA, KINNER AMERICAN EAGLE, Velie Monocoupe, Travel Air. All ships good to excellent condition. Licensed. Cheap. Trades considered. Dick Schall, Berwyn, Md. Telephone: Greenwood 1676.

NEW STINSON: Just delivered January; carefully operated by conservative owner; like new; controllable propeller, all instruments, radio, landing lights, flares, 75 gallon tanks; sacrifice. J. B. DaCamara, Laredo, Texas.

FOR SALE OR TRADE: Nine excellent airplanes. Stinson SM8A, 250 hours total. 1933 Waco Cabin, 110 hours. Two 1934 Waco cabins deluxe, including radio. Waco F-2, clean. J-5 Waco, just rebuilt, air wheels. Waco F, 305 hours. Velie Monocoupe and Curtiss-Wright Jr., the time builder-uppers. Wire or write P. C. Beckman, 15040 Ferguson, Detroit, Michigan.

LAMBERT DELUXE MONOCOUPE: 95 hours, 8 months old; turn and bank, starter, battery, red leather upholstery, wheel pants, tail wheel, magnetos radio shielded; grey trimmed in red. Never damaged. Always privately owned. $2,900. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

COMMAND-AIRE SPECIAL: 125 Warner, biplane. Just recovered. Sport 2-place; square windshields. Beautiful ship. $900. $300 down and balance monthly. Your terms. Cruises 120. Aviation Finance Co., Hemlock, New York.

USED AIRPLANE SALE: Aeronca C-3, $850. OXX-6 Travel Air, $465. Warner Command-Aire, $850. Late Velie Monocoupe, $850. Lambert Coupe, $1,250. J6-5 Stinson, $1,000. Stinson Reliant, $3,000. Kinner Bird, $1,100. Fledgling, $1,050. Kitty Hawk, $1,000. J6-5 Waco, $1,350. Siemens Cessna, $750. Loening Commuter, $1,850. 6-place Stinson, $1,000. Fairchild 22, $1,350. J-5 Travel Air, $1,175. Fleet, $1,150. Eaglet, $550. OX-5 Waco, flyaway present location, $475. First deposit receives preference. "Pioneer," Airport, Syracuse, New York.

FAIRCHILD 22's: With Inverted Cirrus motors; two of them; one brand new; price, $1,850; other beautiful condition, price $1,250. J. M. Byrne, 200 Morse St., Camden, New Jersey.

OX-5 WACO 10: Never cracked, always hangared; compass; 25 x 11 Airwheels; licensed, nice shape, $500. Tee-shaped all metal hangar, 46 ft. span, folding doors. Will load on freight car for $250. Frank C. Reynolds, 601 Arlington, Roanoke, Virginia.

FOR SALE: Aeronca C-3, less than one year old. Total hours, 350. Engine just majored. Ship just relicensed. Extras: Streamline wheels, brakes; position lights; winter enclosure and heater. Price $1,300. Baker-Eberle Aviation Corp., Detroit City Airport, Detroit, Michigan.

TWO-PLACE, all metal, full cantilever, low wing airplane. NC license not available. Will sell, $500 less motor. Write Brown Metalplane Company for details at Spokane, Washington.

FOR SALE: Waco Cabin, 1931, excellent condition; extras: landing lights, upholstery, special streamlining. Colors, black fuselage striped, red wings. Total time, 651 hours; 2 since major overhauled. R. Ballmann, 3075 Victoria Blvd., Cincinnati, Ohio.

LAMBERT MONOCOUPE: For someone interested in a snappy airplane at low operating cost. Maintenance no more than a Ford.. Friendly side-by-side seating. Starter, pants, ring and just relicensed. 250 hours old. See Brownie, Flushing Airport, Flushing, L. I., New York.

TANK TRAVEL AIR: Just relicensed; complete equipment. Radio beam receiver, navigation lights, full air wheels, extra instruments. New generator battery installation. $875. Capitol Airport, Bladensburg, Maryland.

125 WARNER DAVIS: Cruises 115. Steel prop, racing valves, speed ring, Bendix brakes, cockpit cover, radio, nav. lights, compass, dual controls, air speeds and altimeters, oleo struts, many other extras. Total time since complete overhaul ship and motor, 60 hours. A bargain. AERO DIGEST, Box 2083.

TANK ROBIN: Factory condition throughout. Ship total hours 138. Motor since new, 32 hours. Less than 7 gallons per hour gas consumption. Original orange and yellow finish. New Fahlin propeller. Excellent performance. Must be seen to fully appreciate wonderful condition. A bargain at $1,175 cash. Mankato Aero Service, Mankato, Minnesota.

OX-5 CHALLENGER: (Fairchild KR-34) good condition, fine performer, duals, new propeller, yellow wings, green fuselage. Ready flyaway, $350. Terms, trade, delivery. AERO DIGEST, Box 2084.

FAIRCHILD TAPERWING: 2-place sport plane. Kinner 100 h.p. Metal prop. Round nose cowling; brakes; airwheels; 275 hours, all private, no commercial. Perfect covering, etc. Purchased Cabin plane and will sell at once for $1,175. Excellent for private or training. A. C. Lohman, 325 San Gabriel Drive, Rochester, New York.

CLASSIFIED ADVERTISEMENTS

10c. PER WORD; $2.50 MINIMUM. PAYABLE IN ADVANCE.

PLANES and ENGINES FOR SALE

J6-5 TRAVEL AIR: 3-place, duals, complete set instruments, inertia starter. License expires February 1936. Motor and ship has had complete overhaul. Total time 410 hours. Price $1,400. G. F. Monninger, 800 East North Ave., Baltimore, Md.

TRAVEL AIR 2000: Licensed to October 1935. Like new. OX-5 with full Miller overhead and airwheels; 70 hours total flying time; must be seen to be appreciated. Roy S. Clifford, 4208 Corunna Rd., Flint, Michigan.

EXTRA SPECIAL: DeLuxe J6-5 Aristocrat. Modernized and majored. Pants, ring, fairings; blind flying instruments; lights, storage battery; gloss finish. Cruises 117, tops 140. Sacrifice, $1,295. AERO DIGEST, Box 2085.

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Gentlemen:

We have just completed a thorough examination of Jacobs L-4 engine No. 426, after 200 hours of service operation with your Aero Mobiloil. We have no hesitation in stating that this engine is in very excellent condition, internally.

Among the features noted was a remarkable absence of sludge formation and gum deposits. There was considerably less carbon under the piston heads, in the combustion chamber and around the exhaust parts than expected. An unusually slight amount of discoloration had taken place on the master and link rods; this discoloration was very light amber and easily removed. All oil passages were clean and wear on all frictional surfaces was so slight as to be unmeasurable.

This result in service operation confirms the tests of Aero Mobiloil, Red and Green Band, conducted in our laboratory and this oil is now recommended for use in all Jacobs engines.

In addition, we are placing a contract for Aero Mobiloil for our own use.

Yours very truly,

JACOBS AIRCRAFT ENGINE COMPANY
Henry M. McFadgen
Henry M. McFadgen,
Vice President.

TODAY, all grades of Aero Mobiloil are made by the Socony-Vacuum Clearosol Process. See Aero Mobiloil Chart for specific recommendations.

SOCONY-VACUUM OIL CO.

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THIS historic April round-trip flight between United States and Hawaii in 37¾ hours is brilliant proof of the thorough, serious preparation which preceded the flight. The famous S-42 flying boat, as is traditional with PAA aircraft, is Eclipse-equipped. Installed thereon are Eclipse Direct Cranking Electric Starters, Engine Driven Battery Charging Generators, Starter Control Switches and Battery Booster Coils.

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